STATE OF MINNESOTA **DISTRICT COURT**

Master File No. 70-CV-09-19459

In re: Source Code Evidentiary Hearings in Implied Consent Matters

Master File No. 70-CR-09-19749

In re: Source Code Evidentiary Hearings in Criminal Matters

ORDER 20 - ORDER AND MEMORANDUM FOLLOWING FINAL EVIDENTIARY HEARING

The above-entitled matters came before the Honorable Jerome B. Abrams, Judge of District Court, at the Dakota County Judicial Center, Hastings, Minnesota, pursuant to an assignment by the Minnesota Supreme Court. The Court received testimony and exhibits into the record on December 8-10, 2010; December 13-17, 2010; December 20, 2010; December 22 and 23, 2010. Counsel requested the opportunity to submit their final arguments in writing, and the Court ordered the parties to do so by 4:00 p.m. on January 31, 2011. This matter was taken under advisement at that time.

The Court has heard and taken under advisement dispositive motion arguments regarding a Motion in Limine brought on behalf of Prosecutors in the assigned criminal matters and a Motion for Summary Judgment brought by the Minnesota Attorney General's Office in the assigned implied consent matters on November 23, 2010. The Court elected to defer its ruling on these dispositive motions until after the evidentiary hearing was held in December. All parties agreed on the record that the Court should defer its ruling and provide a comprehensive decision on all matters submitted. The decision was further based upon the Court's desire not to further delay the proceedings in order to provide the Court with the necessary time to prepare a written decision which

adequately addressed the dispositive motions. The Court has therefore considered the dispositive motions and the opposition thereto in light of the testimony and exhibits offered into the record during the December hearing.

Counsel directly involved in these proceedings were as follows: (1) appearing as counsel in the assigned criminal matters and on behalf of the implied consent petitioners were Marsh Halberg, Jeffrey Sheridan, Charles Ramsay, and Derek Patrin; (2) appearing as counsel for the criminal defendants represented by Public Defenders in the assigned criminal matters was Pamela King; (3) appearing as prosecution counsel in the assigned criminal matters were Mark Schneider, William Bernard, Sean McCarthy, and Pamela Converse; and (4) appearing as counsel for the Minnesota Attorney General's Office and on behalf of Minnesota's Commissioner of Public Safety were David Voigt, Emerald Gratz, and Kristi Nielsen. William McNabb, counsel for CMI, Inc., was also present but did not formally appear as counsel of record.

At all times the proceedings were open to counsel and the parties involved in the underlying assigned matters, as well as to the public. To the extent other appearances were made by counsel or parties involved in the underlying assigned matters, they have been noted in the record.

Based upon the court files, the proceedings herein, and the substantive record developed by the parties hereto, this Court makes the following:

ORDER

1. The results of breath alcohol testing conducted on the Intoxilyzer 5000EN which express a numerical value for measured breath alcohol are reliable and unaffected by actual or alleged problems with the Source Code of the instrument. To the

extent challenges to test results are premised upon problems with the Source Code, such challenges are overruled, and evidence of same should not be allowed.

2. In cases in which the Intoxilyzer 5000EN running version 75_0240 ("240 software") reported a "Deficient Sample," the Source Code of the instrument does impact the reliability, solely, of this result. Evidence in such cases of a "Deficient Sample" test report should not be allowed unless other evidence exists which provides reasons and/or observations of testing which supports the sample being deficient.

3. The decision herein is limited to challenges of breath alcohol test results based upon the Source Code of the Intoxilyzer 5000EN and is not intended to impair other defenses or challenges as may be permitted.

4. Based upon thorough analysis of the Source Code, and exhaustive presentations made by or on behalf of all parties, this Court will consider new challenges to the Source Code of the Intoxilyzer 5000EN only upon a showing of newly discovered evidence or that a substantial new analysis has been performed which supports position(s) not previously asserted.

5. This Court, in accordance with Minnesota Supreme Court Order A09-2109, retains jurisdiction over pending or new cases which challenge the results of the Intoxilyzer 5000EN based upon the Source Code of the Instrument.

6. The attached memorandum is fully incorporated herein.

Dated: 3-7-11

BY THE COURT:

Jerome B. Abrams
Judge of District Court

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EXECUTIVE SUMMARY[1]

After nearly five years of litigation in Minnesota State and Federal Courts, the question of whether the Source Code for the Intoxilyzer 5000EN affects the reliability of test results produced by that instrument has been decided. For nearly every test result, the Source Code does not affect or diminish reliability. Test results for breath alcohol measurements obtained from the instrument should therefore be admissible in evidence, subject to defenses permitted by law.

The area in which the reliability of an Intoxilyzer 5000EN result can be challenged based on its Source Code is when the instrument reports a "Deficient" sample, while operating software version 240. Changes made to certain aspects of the Code in version 240 render some breath samples that were allowed in the past to be no longer accepted. The 240 software has been in statewide use since mid 2005. It is estimated that this will impact less than 1% of tests.

The Court's decision does not dismiss these cases. "Deficient Sample" results can be used as long as some other evidence is provided for the deficiency. Standing alone, however, the Intoxilyzer report of a "deficient sample" can be the consequence of many causes – including a Source Code change in the 240 software for an unrelated purpose, which has the unintended consequence of tightening sample acceptance.

This decision applies to the Source Code issue which was raised in more than 4,000 cases assigned to this Court by the former Chief Justice. These consolidated cases, both civil and criminal, have been litigated over the past 13 months before the undersigned. Numerous hearings have been held, culminating with a lengthy

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[1] This is an Executive Summary of the Court's decision. This summary is provided as a convenience and should not be construed to modify in any respect the Order and Memorandum.

evidentiary hearing which has effectively resolved an issue that could have been raised in separate hearings, in each case. The procedures adopted by this Court – to which no party has objected – have resulted in an economy for the parties and the Courts.

The attached decision allows these 4,000 plus cases pending in 69 counties throughout Minnesota to be returned to their home county for further proceedings. While this Court remains assigned to all pending and future cases statewide which involve the Source Code for the Intoxilyzer device, it is anticipated that in light of what has been decided herein, sufficient guidance exists for resolution of the Source Code issue in pending and future cases as well.

INTRODUCTION

The issue which is addressed in this decision was framed by former Chief Justice Eric Magnuson in, In re Minnesota Intoxilyzer 5000EN Source Code Litigation, (A09-2109, January 11, 2010). Substantively, Justice Magnuson ordered that "all pretrial matters concerning challenges to the reliability of the Intoxilyzer 5000EN results based on the source code of the instrument" be determined by the undersigned. Procedurally, all such cases, whether criminal or civil in origin, where the challenge to the Source Code which operates the Intoxilyzer 5000EN ("Source Code") was validly asserted, through October 1, 2010, have been consolidated and the Source Code issue is resolved by this decision. For reasons explained below, cases which have been brought since October 1, 2010, where the same issue is asserted are likely indistinguishable from those decided herein. Consequently, unless there is new evidence or new supportable arguments for questioning the impact of the Source Code which operates the Intoxilyzer 5000EN, the issue should be resolved as a final matter in Minnesota.

Not surprisingly, the simple statement of the issue which serves as the guiding principle of this litigation was instantly construed by both sides – those challenging the Source Code and those defending the Intoxilyzer 5000EN's results – differently. Challengers have advanced a fusillade of criticism concerning the Intoxilyzer 5000EN, creatively assigning each shortcoming in the machine a Source Code connection. The State, which is responsible for the operation and maintenance of the instrument, defensively and at times almost cavalierly dismisses every criticism as completely unfounded.

These polarized viewpoints have never diminished. Each side, when given an opportunity to present testimony which resulted in an evidentiary hearing lasting over ten days, could not see any position, abandon any argument, or miss an opportunity at contentious rejoinder. Thus, the Court faces herein the daunting task of stripping from the rhetoric, argument, and contentiousness essential facts which respond to the issue as framed by Chief Justice Magnuson just over a year ago.

Despite the appeal of a decision guided by an economy of words, the vast implications and the tenor of the litigation require in-depth analysis of the claims and evidence, as well as some discussion of the history of this litigation. This decision is presented in three parts: 1) The subject matter requires at the outset some definitions for an understanding of the issue, the history of the cases, and the Court's analysis; 2) The procedural history and genesis of the Source Code issue throughout the state and federal courts in Minnesota; and 3) A summary and overview of the evidence presented at the evidentiary hearing.

DEFINITION OF TERMS

ABA:	An acronym for "Air Blank," "Breath Sample," "Air Blank," which is a shortened test performed on the 5000EN, run without diagnostics or controls, to determine a subject's breath alcohol. It is not evidentiary. It is commonly used by corrections officers to determine the measurement of breath alcohol of individuals out on work release.
ACA:	An acronym for "Air Blank," "Control," "Air Blank." This is principally a diagnostic sequence run to check values for the control solution.
ACCURACY:	The ability of the Intoxilyzer 5000EN to provide breath alcohol concentration results for a single sample which are close together.
ASSEMBLER:	Assembles active instructions in the Source Code for execution by the instrument's "Master" microprocessor.
ASSEMBLY LANGUAGE OR ASSEMBLY CODE:	A very detailed computer language which is utilized in the Source Code of the "Master" microprocessor. It is considered very basic or a low-level language used for code; it requires very detailed instructions. Of the

	approximately 1,100 printed pages of Source Code for the Intoxilyzer 5000EN, about 960 pages are in the "Assembly" language.
C LANGUAGE OR C CODE:	A high-level code language used for computer programming. "C" language can determine calculations and is used for data transfer. The "Slave" microprocessor uses "C" language. Of the approximately 1,100 printed pages of Source Code for the Intoxilyzer 5000EN, about 150 pages are in the "C" language.
COBRA:	Acronym for "Computer Online Breath Archiving." All Intoxilyzer 5000ENs are connected to the Minnesota BCA by modem. The BCA maintains a database for recording results.
COMPILER:	Compiles active instructions in the Source Code for execution by the instrument's "Slave" microprocessor.
DABACABA:	The Minnesota test sequence for the Intoxilyzer 5000EN. An acronym for the full test sequence required by Minn. Stat. 169A.51, Subd. 5(a). "Diagnostic," "Air Blank," "Breath Sample," "Air Blank," "Control," "Air Blank,"

"Breath Sample," "Air Blank."

DEFICIENT SAMPLE: A reported test result for a breath sample which does not meet minimum breath volume of 1.1 liters and/or level slope requirements within 4-minute time limit.
The sample may also be deficient because it does not meet minimum flow rate of 0.17 liters; or sustained flow rate of 0.15 liters; provided over 2 seconds.

DEFICIENT TEST - AGREEMENT NOT MET: Two breath samples which are acceptable but exceed maximum differential of 0.020 from highest to lowest sample readings.

DEFICIENT TEST - REFUSAL: Testing subject provides a second deficient test – which constitutes a refusal.

EMBEDDED SYSTEM: A computer or microprocessor which functions inside another device and controls or generates instructions to all or a portion of that device. The microprocessors in the Intoxilyzer 5000EN are an embedded system.

EPROM: Acronym for "Erasable Programmable Read Only Memory." It is this device in which software changes are

updated and uploaded to the instrument.

FIRMWARE: The in-between of hardware and software; it is the modifiable program that is embedded in the instrument which can be updated.

GRANULARITY: The precise explanation of problems encountered in the software and/or device.

HEX FILE: The file designation for a change in code prepared by CMI, Inc., and forwarded to the BCA for evaluation and/or installation.

INTERFERENT: Detected substance, other than breath alcohol or acetone, which produces vapors that can interfere with test results.

INVALID SAMPLE: Alcohol concentration dropping greater than 0.006 during the process of supplying a breath sample. Possible causes include burping or sucking back.

IR FILTERS: "IR" is short for infrared. There are five IR Filters in the Intoxilyzer 5000EN: two to detect alcohols and acetone;

two to detect interferents; one for reference. The alcohol filters provide data read by a 12-bit sensor, which performs computations to 24 bits. The alcohol data is reported to the "master" as a value with a decimal to four places (0.0000).

PRESSURE TRANSDUCER: An inline measurement device which handles a maximum pressure of 1.45 psi. It turns the subject's air flow into a linear electrical signal. This signal is subject to conversion from analog to digital and then subject to a mathematical formula, which produces a volume reading based on time and pressure.

RELIABILITY: The ability of the Intoxilyzer 5000EN to repeatedly produce highly accurate and valid breath alcohol concentration results across a wide variety of sample subjects.

RFI: Acronym for "Radio Frequency Interference."

SIMULATOR SOLUTION: An ethyl alcohol solution of known concentration which is heated to a specific temperature range to vaporize the ethyl alcohol. The vaporized ethyl alcohol provides a

	known reference measurement at or near an alcohol concentration of 0.08.
SOFTWARE:	The non-physical – instructions. It is nearly synonymous with code.
SOURCE CODE:	Human-readable representation of instructions to be performed by a computer. The Source Code for the Intoxilyzer 5000EN when printed contains over 1,100 pages.
SOURCE CODE MODULE:	Discrete sections of instruction within the broader Source Code which are grouped together because they deal with a specific function or operation of the instrument.
VALIDITY:	The ability of the Intoxilyzer 5000EN to produce breath alcohol concentration results which are reflective of the actual breath alcohol concentration of the subject sample being measured.
Z80 PROCESSOR "MASTER":	A 64K, 16-bit microprocessor. A derivation of the TRS-80 home computer microprocessor sold by Radio Shack in the 1980s. The "Master" receives Source Code

revisions.

8050 PROCESSOR "SLAVE":	A 64K microprocessor which uses 56K and 8K of RAM. The "Slave" receives Source Code revisions.

HISTORY OF SOURCE CODE PROCEEDINGS

Petitioners in implied consent proceedings and defendants in criminal alcohol-related driving prosecutions initially sought access to the computer code which directs the operations of the Intoxilyzer 5000EN instruments in use in Minnesota in 2006. This computer code is virtually unreadable by humans but originates from human-readable "source code."

Petitioners and Defendants originally pointed to language in the Request for Proposal used by the State of Minnesota to purchase its fleet of Intoxilyzer 5000EN instruments and argued that the State of Minnesota legally owned this Source Code, which was unique to Minnesota's version of the Intoxilyzer 5000EN. What followed was a more than three-year-long battle among prosecutors and the Attorney General's Office (acting on behalf of the State of Minnesota), implied consent petitioners and criminal defendants, and CMI, Inc., the manufacturer of the Intoxilyzer 5000EN. Following over three years of litigating discovery and access issues, the cases herein were assigned to this Court for resolution of the underlying claim that the Source Code of the Intoxilyzer 5000EN impaired the reliability of the reported results.

The details underlying the nearly five-year saga and the story behind the discovery, access, and review of the Source Code in use in Minnesota's Intoxilyzer 5000EN fleet are discussed below.

First Request for Discovery of Source Code

The genesis of the challenge to the Source Code of the Intoxilyzer 5000EN in Minnesota can be traced back to 2006 when the first request for discovery of the Source Code for the Intoxilyzer 5000EN was granted. In Underdahl v. Commissioner of Public

Safety, Dakota County Court File 19-C1-06-6710, the Petitioner requested the opportunity to purchase an Intoxilyzer 5000EN instrument and obtain access to the Source Code. The Petitioner's request was premised in part upon "the battle in Florida and elsewhere" over "an unmodified Intoxilyzer 5000EN." (Memorandum and Order for Additional Discovery issued by the Honorable Richard G. Spicer, May 2, 2006, p. 4.) Specifically, the Petitioner contended that Minnesota had a version of source code which was unique and sought to determine whether the specific code in use in Minnesota affected the reliability of the reported results. (See id.) The Petitioner's requests were granted, and the Commissioner of Public Safety was directed to provide Petitioner's counsel with "the complete computer source code for the operation of the Minnesota model of the Intoxilyzer 5000 currently in use in the State of Minnesota." (Id. at 2.)

Underdahl I – Minnesota Attorney General's Request for Writ of Prohibition

In response to the decision granting Underdahl's request for an Order directing discovery be had, the State of Minnesota sought a writ of prohibition from the Minnesota Court of Appeals. Specifically, the State sought relief from the portion of the District Court's Order which required the Commissioner of Public Safety to "obtain and provide to Petitioner's counsel the complete computer source code for the operation of the Minnesota model of the Intoxilyzer 5000 currently in use in the State of Minnesota." In re Commissioner of Public Safety, 735 N.W.2d 706, 709 (Minn. 2007) (Underdahl I). See also, In re Commissioner of Public Safety, A06-1000, p.1 (Minn. App. July 18, 2006) (unpublished opinion of Minnesota Court of Appeals denying requested writ of prohibition). The Minnesota Supreme Court denied the Commissioner of Public Safety

his requested writ of prohibition. Underdahl I, 735 N.W.2d at 713.

In denying the writ of prohibition, the Supreme Court held the District Court had jurisdiction to determine whether individual test results obtained from an Intoxilyzer 5000EN were reliable and accurate. Id. at 710-11. Minnesota Statute § 634.16 provides a presumption that "[i]n any civil or criminal hearing or trial, the results of a breath test . . . are admissible in evidence without antecedent expert testimony that an infrared or other approved breath-testing instrument provides a trustworthy and reliable measure of the alcohol in the breath." See also Kramer v. Commissioner of Public Safety, 706 N.W.2d 231, 235-36 (Minn. App. 2005); State v. Rader, 597 N.W.2d 321, 323-24 (Minn. App. 1999). In reliance upon this statute, the Commissioner argued the only way to challenge the reliability of Intoxilyzer 5000EN tests is to challenge the rule adopting it for statewide use. Underdahl I, 735 N.W.2d at 710. Underdahl, however, was only challenging the specific breath test result being used as evidence against him and then solely upon the basis of the Source Code of the instrument, not the science underlying the approved testing device. See id. at 710-11 (citing Minn. Stat. § 169A.53 which specifically provides jurisdiction to determine whether "the testing method used [was] valid and reliable and [whether] the test results [were] accurately evaluated"). On this basis, the Supreme Court upheld the District Court's jurisdiction to address the Source Code issue. Id. at 712.

The Supreme Court also held the State of Minnesota had adequate remedies under the law to comply with Judge Spicer's discovery order. Id. at 712-13. Without providing an exhaustive list of these remedies, the Supreme Court suggested one possible adequate remedy was for the State to enforce its contract with CMI. Id. at 713.

The Request for Proposal to which CMI submitted a bid and led to a contract for the purchase of Minnesota's Intoxilyzer 5000EN fleet required a "[p]rovision for information . . . to be used by attorneys representing individuals charged with crimes in which a test with the proposed instrument is part of the evidence" and "to be activated with an order from the court with jurisdiction of the case . . . ." (Exhibit 1, Bates p. 000024, Minnesota's Request for Proposal). (See Exhibit 45, Bates p. 000036, CMI, Inc.'s Response to RFP). See also Underdahl I, 735 N.W.2d at 713. The Supreme Court reasoned that by enforcing its contract with CMI, the State could obtain access to the Source Code in question and thereby comply with Judge Spicer's discovery order. Id. at 713. On these bases, the request for a writ of prohibition was denied. Id. at 713.

Minnesota Sues CMI, Inc., in United States District Court

On March 3, 2008, the State of Minnesota commenced litigation against CMI, Inc., by filing a complaint in United States District Court for the District of Minnesota. (Complaint dated March 3, 2008, filed in State of Minnesota v. CMI of Kentucky, Inc., 2008-CV-00603.)[2] The matter was assigned to the Honorable Donovan W. Frank and referred to the Honorable Arthur J. Boylan. Through the hard work and diligence of Judge Frank and Magistrate Judge Boylan, resolution of the access issue was reached which provided "reasonable access to the Source Code for Minnesota litigants in a manner that protects the State's interest in security features and passcode-protected functions, and CMI's interest in its intellectual property." (Order Approving Consent

[2] The Court's knowledge of all of the documents and orders filed in the proceedings before the Honorable Donovan W. Frank in State of Minnesota v. CMI of Kentucky, Inc., 2008-CV-00603 (D. Minn. 2008) were derived from reviewing reproductions of the documents filed with the United States District Court for the District of Minnesota as published at the following website: http://dockets.justia.com/docket/minnesota/mndce/0:2008cv00603/96668/. Review of this website was undertaken at various times throughout these proceedings.

Judgment and Permanent Injunction and Memorandum, July 16, 2009, issued by Judge Frank in State of Minnesota v. CMI of Kentucky, Inc., 2008-CV-00603, pp. 6-7). ("Consent Judgment and Permanent Injunction"). Although not binding upon Minnesota state courts, the Consent Judgment and Permanent Injunction provided state courts, petitioners in implied consent cases, and criminal defendants with a means of access through which review of the Source Code for the Intoxilyzer 5000EN could occur. (See id. at 3, 19-20) (acknowledging not binding upon state courts).

Intervention by Criminal Defendants and Implied Consent Petitioners

During the course of this litigation, four individuals[3] who were either petitioners challenging the Commissioner's revocation of their driver's license or criminal defendants sought to intervene in the proceedings. (Motion to Intervene as Plaintiffs, filed in State of Minnesota v. CMI of Kentucky, Inc., June 6, 2008, 2008-CV-00603.) These individuals sought to intervene in the federal court proceedings because they believed the State of Minnesota would not adequately represent their interests in obtaining access to the Source Code. (Id. at 2.) This request for intervention, as well as requests by various amicus curiae[4] to be involved in the proceedings, was granted. (November 6, 2008 Order issued by Judge Frank in State of Minnesota v. CMI of Kentucky, Inc., 2008-CV-00603, p. 5. (granting motion of intervenors); November 26, 2008 Order issued by Judge Frank in State of Minnesota v. CMI of Kentucky, Inc.,

[3] These individuals were Craig A. Zenobian, Shane M. Steffensen, Robert J. Bergstrom, and Christopher D. Jacobsen. Zenobian (Court File Number 10-CV-07-1076), Steffensen (Court File Number 10-CV-06-1036), and Bergstrom (Court File Number 27-CV-07-8280) have their challenge to Intoxilyzer 5000EN result on the grounds of Source Code assigned to this Court in this proceeding for resolution. Jacobsen (Court File Number 02-CR-07-370) apparently entered into a plea agreement on July 3, 2008, resolving the matter.

[4] The amicus curiae who elected to participate included the Minnesota Society for Criminal Justice, the DWI Taskforce, the Minnesota County Attorney's Association, and the Suburban Hennepin County Prosecutors Association.

2008-CV-00603 (allowing amicus curiae briefing); June 3, 2009 Order issued by Judge Frank in State of Minnesota v. CMI of Kentucky, Inc., 2008-CV-00603, p. 5 (allowing amicus curiae briefing and argument).) The intervenors and the amicus curiae Minnesota Society for Criminal Justice ("MSCJ") were able to have their objections heard regarding the Consent Judgment and Permanent Injunction. (See June 3, 2009 Order issued by Judge Frank in State of Minnesota v. CMI of Kentucky, Inc., 2008-CV-00603, p. 5.) Despite their objections, the intervenors, MSCJ, and all of the litigants appearing before this Court followed and urged this Court to follow the process approved in the Consent Judgment and Permanent Injunction.

The access provided by the Consent Judgment and Permanent Injunction was apparently the only process through which access to the Source Code was obtained on a broad scale. There has been a reference to one instance when CMI provided access to some version of the Source Code to one litigant. (See July 16, 2009 Memorandum Opinion and Order issued by Judge Frank in State of Minnesota v. CMI of Kentucky, Inc., 2008-CV-00603, p. 12 n. 9.) With this exception, this Court is unaware of any other instance wherein a litigant currently before this Court obtained access to the Source Code by some method other than that put forth in the Consent Judgment and Permanent Injunction. Despite repeated invitations by this Court and other Minnesota state court judges for criminal defendants or implied consent petitioners to directly involve CMI in their case, the process set forth by the Consent Judgment and Permanent Injunction was the one adopted by the litigants herein. To the extent courts across Minnesota attempted to hold CMI in contempt or issued sanctions against the State or local prosecutors, including dismissal of cases, suppression of breath test

results, and other measures for non-compliance with discovery orders, these processes did not result in any other form of access to the Source Code.

Details of Consent Judgment and Permanent Injunction

The process set forth in the Consent Judgment and Permanent Injunction required implied consent petitioners and criminal defendants to follow three steps in order to obtain access to the Source Code. (Consent Judgment and Permanent Injunction, pp. 11-12.) First, a Minnesota state court judge had to order production of the Source Code or make express findings that the Source Code was relevant to a breath alcohol concentration test result at issue in the case. (Id. at 11.) Second, a protective order designating the Source Code as confidential had to be issued by the Minnesota state court judge. (Id. at 12.) A proposed protective order was included as an attachment to the Consent Judgment and Permanent Injunction. (Id. at Exhibit 1.) Third, any person obtaining access to the Source Code had to execute the non-disclosure agreement included as a second attachment to the Consent Judgment and Permanent Injunction. (Id. at 11-12, Exhibit 2.) By complying with these three steps, a petitioner in an implied consent case, a criminal defendant, a prosecuting authority, the State of Minnesota, their counsel, or an expert retained to assist in litigating their case could obtain access to the Source Code. (Id. at 7-14.)

The Consent Judgment and Permanent Injunction provided access to a printed, hardbound copy of the Source Code and a native electronic version of the Source Code currently installed in Minnesota's Intoxilyzer 5000EN fleet.[5] (See Consent Judgment

[5] On August 11, 2010 this Court issued Order 13 which addressed an access and discovery issue the plaintiffs and criminal defendants encountered relating to "additional text" (AT) or "additional text code" (ATC) on the slave erasable programmable read only memory (EPROM) they obtained from an instrument they are leasing from the State of Minnesota. This AT or ATC was not present on the slave

and Permanent Injunction, pp. 7-10.) Access to the printed, hardbound version of the Source Code was available in Minnesota for a fee of $250; or $125 if requested as part of a publicly funded defense.[6] (Id. at 10.) Access to the native electronic version of the Source Code was available without charge at CMI's corporate headquarters in Kentucky.[7] (Id. at 7-9.) Also available in Kentucky for review were the compiler, assembler, linkers, and associated peripherals used by CMI to convert the Source Code into the HEX files ultimately burned onto the EPROMs placed into Minnesota's Intoxilyzer 5000EN instruments. (Id. at 7.) Additional peripherals, such as an Intoxilyzer 5000EN instrument, printer, and simulator solution, were also made available. (Id.)

After hearing the positions of the State of Minnesota, CMI, the intervenors, and amicus curiae, Judge Frank concluded this level of access was "reasonable and, in fact, [provided] unprecedented access to the Source Code for the Intoxilyzer." (Id. at 14.)

EPROM the petitioners' and defendants' experts had received from CMI, Inc. during their Source Code review in Kentucky. The petitioners and defendants believed the AT or ATC may have an operational interaction with the other code on the slave EPROM through the "buffer overflow" which could cause unexpected results in the operation of an Intoxilyzer 5000EN. The Court amended its scheduling order to grant the petitioners and defendants additional time to further investigate this issue. Ultimately, all of the experts who reviewed the matter concluded that even though the AT or ATC present on some of the EPROMs was active code which could have been operational, it was not accessed by any of the code which operated the instrument. Therefore, the AT or ATC has no functional interplay with the Source Code installed in Minnesota's instruments and does not impact operation or results.

[6] The "Source Code language controlling or constituting the instrument's network security features and menu passcodes" was redacted from this version to protect "the security of the State's networked system of Intoxilyzer 5000EN breath-alcohol testing instruments." (Consent Judgment and Permanent Injunction, pp. 4, 6, 10.)

[7] The intervenors in State of Minnesota v. CMI of Kentucky, Inc. (Court File Number 2008-CV-00603, (D. Minn.) and amicus curiae MSCJ objected to the requirement that they or their experts travel to Kentucky to review the Source Code. (Consent Judgment and Permanent Injunction, p. 16; Plaintiffs-Intervenors' Objection and Memorandum in Opposition to Proposed consent Judgment, filed June 12, 2009 in State of Minnesota v. CMI of Kentucky, Inc., 2008-CV-00603 (D. Minn.), pp. 9-11; Brief of Amicus Curiae – Minnesota Society for Criminal Justice, filed June 12, 2009 in State of Minnesota v. CMI of Kentucky, Inc., 2008-CV-00603 (D. Minn.), pp. 4-5.) This objection was based, at least in part, upon the cost of travel to Kentucky for experts or counsel. The assignment of these cases to a single judge allowed the implied consent petitioners and criminal defendants to pool their resources and thereby reduce the burden of travel expenses.

Judge Frank further concluded the access ordered was "in the public interest, as well as in the interests of justice" and properly balanced CMI's "intellectual property rights" with implied consent petitioners' and criminal defendants' need for access. (Id. at 14-15.) After hearing testimony during the evidentiary hearing from three of the experts who reviewed the Source Code that they had sufficient access to what was needed to perform their analysis, this Court shares Judge Frank's conclusion that the access provided was reasonable, in the public interest, and served the interests of justice.[8]

Underdahl II – Source Code Discoverable if Minimal Showing Made

As the federal court case regarding access to the Source Code was pending, the Minnesota Court of Appeals and Minnesota Supreme Court were deciding when a request for discovery of the Source Code should be granted or denied. See State v. Underdahl, 767 N.W.2d 677, 684-86 (Minn. April 30, 2009), rehearing denied July 22, 2009 (Underdahl II); State v. Crane, 766 N.W.2d 68, 71-2 (Minn. App. June 2, 2009), review denied Aug. 26, 2009; Abbott v. Commissioner of Public Safety, 760 N.W.2d 920 (Minn. App. Feb. 17, 2009); State v. Underdahl, 749 N.W.2d 117, 120-23 (Minn. App.

[8] The Court is aware of four individuals identified as expert witnesses in these proceedings who obtained access in Kentucky to the native electronic version of the Source Code: Dr. Karl Schubert and Mr. Matthew Willis with Computer Forensic Services ("CFS") who were retained by the Source Code Committee of MSCJ ; Dr. Steven Nuspl with Mitrin, Inc., who was retained by the State of Minnesota; and Mr. Timothy Black with Quantalink, LLC, who was separately retained by Derek Patrin, counsel for approximately 26 implied consent petitioners and approximately 22 criminal defendants with their cases assigned to this Court. Schubert and Nuspl both testified they had adequate access to perform their review of the Source Code and reach the opinions they offered before this Court. Black testified that his access issues were resolved with the exception of that imposed by the funding available for his review and analysis. Regardless of this restriction, Black testified he had an adequate opportunity to perform his Source Code review within the purview of the analysis he conducted. Although Willis testified, his testimony was limited to providing evidence to undermine the credibility of Schubert. The expert report he helped draft, however, indicated he and Schubert "performed a comprehensive review of the source code for all Intoxilyzer 5000EN [] instruments in use in Minnesota [and] encompassed a detailed analysis of the source code [and] the software and methods used to turn the source code into machine code . . . ." (Tr. Ex. 166, p. 4.) Based upon this evidence of the experts' satisfaction with the access they were afforded and the fact that no other attempts at alternate access were undertaken, this Court concludes the access provided by the Consent Judgment and Permanent Injunction was sufficient.

May 20, 2008), affirmed in part and reversed in part by Underdahl II, 767 N.W.2d 677. These Courts held that so long as the defendant or petitioner made a minimum showing in support of their request for discovery of the Source Code, then the discovery could be granted. Underdahl II, 767 N.W.2d at 685-86; Abbott, 760 N.W.2d at 925-26. If this minimum showing was not made, then the discovery of the Source Code could be denied. Id.; Abbott, 760 N.W.2d at 925-26. The minimum showing required of parties requesting discovery was that the Source Code was relevant to determining the validity of breath alcohol concentration results. Id.; Abbott, 761 N.W.2d at 925-926.

Adoption of Discovery Request by Criminal Defense and Implied Consent Petitioner Bar

Following the Supreme Court's decision in Underdahl I, much of the criminal defense and implied consent petitioner bar began making a request for discovery of the Source Code part of their standard litigation strategy. With the decisions in Underdahl II and Abbott, these requests also began including a standardized submission of affidavits which purported to make the minimum required showing. The requested discovery was granted in cases venued in at least 69 counties in the State; at least 66 counties had a request granted in an implied consent proceeding and at least 65 counties had a request granted in a criminal proceeding. (See Exhibit A, list of Implied Consent Cases, and Exhibit B, list of Criminal Cases, assigned to this Court as of October 1, 2010.) Furthermore, the request for discovery of the Source Code was granted, as of October 1, 2010, in more than 4,200 cases across the state.[9] (See id.)

As the number of cases in which discovery was granted increased, so too did the

[9] Requests for discovery were made in many more cases which were either denied or granted and resolved in some manner other than assignment to this Court. The specific data available to this Court, however, was limited to those cases which were assigned pursuant to the Minnesota Supreme Court's January 11, 2010 Order, A09-2109 (entitled In re Minnesota Intoxilyzer 5000EN Source Code Litigation).

variety of dispositions. Prior to the approval of the Consent Judgment and Permanent Injunction on July 16, 2009, some cases were dismissed outright as a sanction against the State for failing to provide the Source Code pursuant to a discovery order. (See June 3, 2009 Order of the Honorable Donovan W. Frank filed in State of Minnesota v. CMI of Kentucky, Inc., pp. 2-3, 2008-CV-00603 (D. Minn.). Other cases were resolved through plea agreements. The vast majority of the cases, however, either went into limbo or a circuitous rescheduling process. In some situations, cases remained open but no further hearings, action, or resolution were scheduled until the issue of access to the Source Code was resolved. In other situations, cases were continuously rescheduled for hearings at which nothing occurred. Counsel would appear, advise the court the case was one in which a request for discovery of the Source Code had been granted, and either request dismissal as a sanction or request a further continuance because the issues regarding access to the Source Code remained unresolved. In either instance, the cases stagnated and justice was denied to the litigants.

A means of providing actual access to the Source Code was not available to the courts until after the Consent Judgment and Permanent Injunction was approved by Judge Frank on July 16, 2009. CMI was resisting attempts to obtain access to the Source Code for the Intoxilyzer 5000EN through indirect means, and no criminal defendants or implied consent litigants sought to subject CMI to the personal jurisdiction of Minnesota's state courts. Even though access to the Source Code was eventually possible through the process described in the Consent Judgment and Permanent Injunction, there was no process in place for resolving the backlog of criminal and implied consent cases.

In addition to identifying other problems in accessing the Source Code pursuant to the Consent Judgment and Permanent Injunction, criminal defendants and implied consent petitioners complained about it being too costly for any single litigant or counsel to analyze the Source Code. Local prosecutors and the Minnesota Attorney General's Office complained about trying the exact same Source Code issue in thousands of pending cases. In response to these concerns and with the hope of providing fair and efficient administration of justice, a process was initially developed by the undersigned in the First Judicial District which allowed the available resources to be combined, and thereby enabling a thorough review of the Source Code.[10]

First Judicial District Assignment

On August 6, 2009, First Judicial District Chief Judge Edward Lynch assigned all "civil implied consent and criminal driving while impaired matters involve[ing] challenges to the accuracy and reliability of the test results obtained from tests conducted with the Intoxilyzer 5000EN breath testing instrument based upon alleged defects in the source code" which arose in the First Judicial District to this Court. (August 6, 2010, Order of Chief Judge Edward Lynch, p. 1 (entitled In re: Source Code Evidentiary Hearings in Implied Consent and Criminal Matters) ("First Judicial District Assignment Order"). This First Judicial District Assignment Order (hereinafter "Assignment Order") specifically directed this Court "to hear and decide only challenges to the accuracy and reliability of the test results obtained from breath tests administered with the Intoxilyzer based upon alleged defects to the source code." (Id. at 2.) Upon resolution of this sole issue, the

[10] Despite invitations by Judge Frank and this Court to select a bellwether case or cases to try as a basis for providing resolution for all of the cases, the litigants declined to pursue this course. (See April 16, 2009 Letter from The Honorable Donovan W. Frank to counsel for the parties in State of Minnesota v. CMI of Kentucky, Inc., 2008-CV-00603.

cases were to be returned to their original jurisdictions for final resolution by either trial in the criminal matters, or by the hearing required under Minnesota Statute § 169A.53, Subd. 3, in the implied consent matters. (Id.) The Assignment Order also specifically notified litigants that "[o]rders, notices, hearing dates and a list of cases assigned to" this Court would be posted on the First Judicial District's web page for their reference. (Id.) Counsel and the parties in each case assigned pursuant to this Order received a copy of the Order at the time of assignment.

Master Files

In conjunction with the First Judicial District assignment, this Court directed Scott County Court Administration, which initially and primarily undertook the administrative responsibilities for the assignment, to open two master files for the First District assignment proceedings. One file was for the implied consent proceedings (70-CV-09-19459), and the second was for the criminal proceedings (70-CR-09-19749). On October 21, 2009, this Court issued an Order in these two master files setting an initial hearing date for November 4, 2009, in the matters assigned pursuant to the Assignment Order. (Order Setting Agenda for Hearing, filed October 21, 2009, in Court Files 70-CV-09-19459 and 70-CR-09-19749.) The purpose of this hearing was to inform counsel of the Court's plan for resolving these cases and to obtain whatever input counsel or the parties had regarding the process.

Decision to Proceed under Assigned Case Method

One of the initial matters addressed by the Court was what form the Source Code challenge to the accuracy and reliability of breath alcohol testing results should take. Specifically, counsel and the Court discussed whether counsel and the parties

wanted to select a test case or test cases or if they wanted to proceed with all of the cases under the Assignment Order. Counsel informed the Court they would prefer to have all of the cases proceed simultaneously pursuant to the assignment. The Court was also informed that a request for a statewide assignment by the Chief Justice of the Minnesota Supreme Court was in the works but had not yet been filed. This Court encouraged such a request because it provided a process for expedient and just resolution of this issue on a statewide basis rather than just in the First Judicial District.[11]

The Court also discussed with counsel the progress made towards obtaining experts who would review the Source Code. All counsel agreed that expert testimony and expert review of the Source Code were necessary to mount a challenge to the reliability of breath alcohol concentration testing results obtained in each case from Intoxilyzer 5000EN instruments across the State. The Source Code itself and the process of implementing it into Intoxilyzer 5000EN instruments in use in the State of Minnesota are not matters of common experience within the purview of laypersons. The challengers indicated early in the process that they would likely be pooling or sharing experts given the complexity and likely significant cost.

Method of Access to Source Code

The only effective means available to this Court to allow for access to the Source Code was through the process set forth by the Consent Judgment and Permanent Injunction. After reviewing the Consent Judgment and Permanent Injunction, listening to counsel's concerns, considering the need to obtain access to the Source Code, and

[11] Other judicial districts, including the Second and the Fourth, had also adopted specialized procedures for dealing with cases in which a Source Code challenge was present.

confirming no other effective process was available, this Court adopted the process set forth in the Consent Judgment and Permanent Injunction. The Consent Judgment and Permanent Injunction required a judicial order finding discovery of the Source Code was necessary or relevant, issuance of a protective order, and execution of a non-disclosure agreement by the person or persons obtaining access to the Source Code. In adopting the process specified by the Consent Judgment and Permanent Injunction, this Court required litigants who sought to have their matter assigned pursuant to the Assignment Order to obtain a protective order and file a non-disclosure agreement from at least one expert retained to perform an analysis of the Source Code. The filing of these two documents was tracked and used to determine what cases were subject to the Assignment Order.[12] Once a protective order and non-disclosure agreement had been filed in a particular case, the matter was identified as one subject to the Assignment Order and was entered into a database created exclusively for that purpose.

Inquiry Pursuant to Rule 104 of the Minnesota Rules of Evidence

Finally, the Court informed counsel it considered the proceedings before it as one under Rule 104 of the Minnesota Rules of Evidence addressing whether the results provided by Intoxilyzer 5000EN instruments used in the individual cases were rendered unreliable or inaccurate as a consequence of the Source Code in use. Rule 104 provides that "[p]reliminary questions concerning . . . the admissibility of evidence shall be determined by the court . . . ." The charge posed to this Court by the Assignment Order was to resolve challenges to the accuracy and reliability of the test results

[12] This Court did not monitor the issuance of orders granting the request for discovery of the Source Code because: (1) to do so would have been redundant when, to the extent a request for discovery was granted, a protective order would also have been issued and a non-disclosure agreement filed, and (2) any error in granting or denying a request for discovery of the Source Code would properly have been addressed to the Minnesota Court of Appeals, not this Court.

obtained from Intoxilyzer 5000EN instruments based upon alleged defects in the Source Code. These results would otherwise be deemed accurate, reliable, and admissible as a matter of law subject to criminal defendants' and implied consent petitioners' right to challenge the validity and reliability of the test. Minn. Stat. §§ 169A.53, subd. 3(10) (allowing implied consent petitioners to challenge whether the testing method was valid and reliable) and Minn. Stat. 634.16 (providing presumption that "breath-testing instrument provides a trustworthy and reliable measure of the alcohol in the breath"), cited by Underdahl II, 767 N.W.2d at 685 n. 4. See also State v. Birk, 687 N.W.2d 634, 637-39 (Minn. App. 2004) (discussing Minn. Stat. § 634.16 in perspective of criminal prosecution). In other words, the criminal defendants' and implied consent petitioners' challenge was whether the Source Code rendered the test results inadmissible because it somehow impacted the validity, accuracy, and reliability of the test results and thereby deprived them of evidentiary value. Determining questions of admissibility or suppression of the test results on such grounds is a question which is properly addressed under Rule 104. See State v. Martin, 293 Minn. 116, 123-26, 197 N.W.2d 219, 224-25 (1972) (approving of use of "special hearings" equivalent to Rule 104 hearing to determine application of marital presumption prior to claim of marital privilege). See also State ex rel. Rasmussen v. Tahash, 272 Minn. 539, 556, 141 N.W.2d 3, 14-15 (1966) (encouraging use of pretrial proceedings when practical to resolve evidentiary problems and assure the integrity of trial).

Case Management Orders

The initial hearing held in the matters assigned to the Court pursuant to the Assignment Order resulted in two Case Management Orders. Although substantially

similar, one Case Management Order applied specifically to all implied consent cases assigned, while the other applied specifically to all criminal cases assigned. These Orders provided counsel and the parties rules in addition to the Rules of Civil and Criminal Procedure, guidance regarding things such as discovery, motion practice, method of service, notice, and manner in which materials were filed with Court Administration. The Case Management Orders also addressed scheduling, including the Court's regular involvement in the proceedings by providing an opportunity for regular bi-weekly status conferences, deadlines for the completion of discovery, and scheduling of the final hearing dates.

To assist the Court and the litigants in organizing the multitude of parties and counsel into a manageable group for hearings and regular contact, the Court appointed Liaison Counsel. These lawyers were volunteers selected from the four major and identifiable groups of litigants appearing before the Court in these matters: prosecutors, the Attorney General's Office, criminal defendants, and implied consent petitioners. In some instances, Liaison Counsel were selected based upon further identifiable sub-groups, such as municipal and county prosecutors, groups of criminal defendants or implied consent petitioners who had retained or planned to retain separate experts, or defendants represented by a public defender. With their consent, Liaison Counsel were given the following responsibilities: (1) act as a communication point for counsel within their group, other Liaison Counsel, and the Court; (2) forward all communication from the Court or Court Administration to counsel within their group; (3) organize and schedule joint actions of counsel; (4) coordinate common discovery; and (5) initiate action before the Court to address disputes.

The designation of Liaison Counsel in no way prevented any party or counsel from being involved in any conference, hearing, or other communication with other counsel or the Court. The Case Management Orders specifically provided that "Liaison counsel shall not be deemed to speak for, act for, or bind any particular party absent express authority provided by such party." (Case Management Order issued December 1, 2009, in District Court File Number 70-CV-09-19459, p. 20; Case Management Order issued December 1, 2009, in District Court File Number 70-CR-09-19749, p. 20.) The Case Management Orders further provided that "[a]ll counsel of record shall have an opportunity to present to this Court their respective views and opinions as to matters before this Court." (Id.) Generally speaking, however, counsel and the parties relied upon Liaison Counsel to express their positions, viewpoints, and opinions with respect to the issues before the Court.

Statewide Assignment by Chief Justice of Minnesota Supreme Court

The process undertaken in the First Judicial District was interrupted in January 2010 when the request was granted to have a single judicial officer assigned to hear and determine matters statewide raising the challenge to the validity, accuracy, and reliability of Intoxilyzer 5000EN results based upon the instrument's Source Code. The Minnesota Attorney General's Office, along with eighteen municipal prosecuting authorities, requested that Chief Justice Eric J. Magnuson appoint a single judge or panel of judges to resolve this issue. After considering this request and an objection filed by the Chief Public Defender of the Seventh Judicial District, Chief Justice Magnuson determined assignment to a single judge was in the interests of the parties and the judiciary. (In re Minnesota Intoxilyzer 5000EN Source Code Litigation, A09-

2109, p. 2-3 (Minn. Jan. 11, 2010) ("Supreme Court Assignment Order"). Chief Justice Magnuson assigned these matters to this Court.

Nature of Statewide Assignment

The scope of the assignment to this Court involved a single issue common to several groups of cases. This single issue involved resolving challenges to the reliability of Intoxilyzer 5000EN results based upon the Source Code of the instrument. Specifically, this Court was assigned "to administer, hear, and decide all pretrial matters concerning challenges to the reliability of Intoxilyzer 5000EN results based on the source code of the instrument, including scheduling, discovery, and an evidentiary hearing . . . in which a party challenges the reliability of Intoxilyzer 5000EN results based on the source code of the instrument."[13] (Id. at 3 (assignment language for implied consent cases). (See also id. at 4 (nearly identical assignment language for criminal cases).) This Court's authority was therefore limited to pretrial matters and cases in which the Source Code of the Intoxilyzer 5000EN was challenged as impacting the reliability of the instrument's results.

The statewide assignment to this Court consisted of three groups of identifiable cases. The first group was all pending and future implied consent matters in which the Source Code challenge was raised. (Id. at 3.) The second group was all pending and future criminal cases in which the Source Code issue was raised and "both the prosecuting authority and the defendant provide[d] written notice to [this Court] of their consent to th[e] assignment." (Id. at 4.) The third group was in some ways an already identified subset of the second group and included all of the criminal cases listed in an

[13] There were some implied consent and criminal matters arising in the First Judicial District from which this Court had been removed. The Honorable Karen J. Asphaug was appointed to hear those matters.

addendum to the Supreme Court Assignment Order so long as the defendant was not represented by a public defender. (Id. at 4.)

At no time since the Statewide Assignment Order of Justice Magnuson has any party objected to it or to the Orders promulgated by this Court to provide processes for its implementation.

Joint United States District Court and Minnesota State District Court Hearing

After receiving the Supreme Court assignment, this Court scheduled an initial hearing similar to the one held in the First Judicial District Assignment Cases. Issues had also arisen in the First Judicial District Cases regarding the implied consent petitioners' and defendants' access to the Source Code at CMI's facilities in Kentucky. These issues primarily involved interpretation of the scope of the Consent Judgment and Permanent Injunction issued by Judge Frank in the Federal Lawsuit. Resolution of issues related to access was necessary for the cases assigned in this statewide proceeding to progress. The interdependence of the matters assigned to this Court and the case before Judge Frank and Magistrate Judge Boylan led to a joint United States District Court and Minnesota State District Court hearing. Judge Frank and Magistrate Judge Boylan dealt with the issues surrounding access to the Source Code, and this Court discussed the statewide assignment of the Source Code Issue; specifically, the issuance of case management orders, the designation of Liaison Counsel, the process to be followed for inclusion within the scope of the statewide assignment, and the inquiry being undertaken pursuant to Rule 104 of the Minnesota Rules of Evidence. (See Order 2 – Order Setting Agenda for Hearing, filed February 24, 2010; February 26, 2010 Order for Joint Federal-State Status Conference issued by Judge Frank in State of

Minnesota v. CMI of Kentucky, Inc., 2008-CV-00603.)

Case Management Orders

The outcome of the joint Federal and State hearing was ultimately resolution of the access issues by Judge Frank and Magistrate Judge Boylan and issuance of Case Management Orders by this Court. The Case Management Orders were similar to those issued as part of the First Judicial District Assignment. One Case Management Order was issued for the implied consent cases assigned, while a second one was issued for all of the criminal cases. The two Case Management Orders were substantially similar but addressed the unique differences between the civil nature of the implied consent cases and the criminal nature of the alcohol-related driving cases.

The Court also retained the use of the Master Case File Numbers, 70-CV-09-19459 for the implied consent cases and 70-CR-09-19749 for the criminal cases, which had been developed for the First Judicial District Assignment. The continued use of these case numbers provided a centralized source for the record of the proceedings occurring in the Statewide Assignment. Continued use of the files generated for the First Judicial District Assignment was a matter of practicality. Many of the counsel, Court Administrators and staff, and other members of the Judicial Branch who also became involved in the Statewide Assignment were aware of those file numbers. Furthermore, the First Judicial District Assignment was subsumed within the Statewide Assignment prior to resolution.[14] This thereby rendered the created files superfluous unless otherwise re-purposed for use in the Statewide Assignment proceedings. The file numbers were therefore re-used.

[14] The First District consolidated Source Code proceeding was terminated on February 17, 2010, by reason of being succeeded by this statewide consolidation.

Designation of Liaison Counsel

To assist the Court and the litigants in organizing the multitude of parties and counsel into a manageable group for hearings and regular contact, the Court appointed Liaison Counsel in this case. These lawyers were volunteers selected from the same four major and identifiable groups and subgroups of litigants appearing before the Court in the First Judicial District action. With their consent, Liaison Counsel were given the same responsibilities as those in the First Judicial District action.

The designation of Liaison Counsel in no way prevented any party or counsel from being involved in any conference, hearing, or other communication with other counsel or the Court. The Case Management Orders specifically provided that "Liaison counsel shall not be deemed to speak for, act for, or bind any particular party absent express authority provided by such party." (Case Management Order filed April 21, 2010, in District Court File Number 70-CV-09-19459, p. 20; Case Management Order filed April 21, 2010, in District Court File Number 70-CR-09-19749, p. 21.) The Case Management Orders further provided that "[a]ll counsel of record shall have an opportunity to present to this Court their respective views and opinions as to matters before this Court." (Id.) Generally speaking, however, counsel and the parties relied upon Liaison Counsel to express their positions, viewpoints, and opinions with respect to the issues before the Court.

Procedural Process Implemented to Identify and Manage Cases

Before the Court could address the Source Code issue common to all of the assigned cases, the cases subject to the assignment had to be identified. As previously discussed, there were three identifiable groups of cases which were assigned by Chief

Justice Magnuson for resolution of the Source Code issue: the specifically enumerated cases, all implied consent cases, and criminal cases in which written consent was given. The process for identifying each type of case were similar to one another and to the process originally generated as part of the First Judicial District Assignment, but with enough of a difference to warrant further discussion.

The Supreme Court Assignment Order implemented an additional requirement above and beyond those developed for identifying cases subject to the First Judicial District Assignment. As part of the Statewide Assignment, written consent was required of defendants and prosecutors. This requirement was in addition to what had been set out in the Consent Judgment and Permanent Injunction approved by Judge Frank. The consent was given in writing in all criminal cases in the form attached as Exhibit C hereto. Notably, the defendant, defense counsel, and the prosecution all had to agree to be part of these consolidated proceedings, including agreement with procedures set forth in the Case Management Order. Those consenting were expressly consenting to the appointment of Liaison Counsel and methods of service, inter alia, as provided for in the Case Management Order. Any expert retained by an implied consent petitioner or criminal defendant to review the Source Code had to execute a non-disclosure agreement, and the court ordering production of the Source Code had to issue a protective order These requirements were also in addition to the practical need to differentiate between cases in which the Source Code issue could properly be raised, those in which a breath test had occurred, and those in which it was not and could never be relevant, such as cases wherein a blood test, urine test, or some other non-breath test method was being used in support of a license revocation or criminal

prosecution.

The group of cases which could be identified in the most straightforward manner was those specifically enumerated by Chief Justice Magnuson in the Supreme Court Assignment Order. These cases were expressly identified and assigned to this Court for resolution of the Source Code issue unless a criminal defendant was represented by a public defender. Court Administration worked with counsel, specifically the public defender's offices, and the parties to determine whether a public defender was assigned to a defendant in each case. If a public defender was assigned to represent a defendant in a given matter, then it was subject to the same requirements, including written consent, as all other criminal matters.

The most complicated group of cases which could be identified was all of the criminal cases not specifically enumerated in the Supreme Court Assignment Order. Such matters were identified and confirmed through a multi-step process. First, defendants made a discovery request for access to the Source Code from the presiding judge in the originating county. The presiding judge independently reviewed the defendant's request for a showing of relevance in accordance with the standards set forth in Underdahl II, 767 N.W.2d at 685-86. If the presiding judge determined an adequate showing of relevance had been made, then the presiding judge would order discovery of the Source Code and issue a protective order. Court Administration would also identify the case as one which may end up assigned to this Court pursuant to the Statewide Assignment Order and begin tracking the case for that purpose. The defendant could then file a non-disclosure agreement executed by the expert retained to review the Source Code and a Written Notice of Consent to Assignment executed by

the prosecutor, defense counsel, and defendant.[15] This Written Notice of Consent to Assignment was a formalized means of complying with the additional requirement imposed by the Supreme Court Assignment Order and provided a means of confirming which matters were assigned. Once this Court had received the Written Notice of Consent to Assignment and Court Administration in the originating county had a record of a protective order, an executed non-disclosure agreement, and the Written Notice of Consent to Assignment, then the matter was added to a master list of individual cases assigned to this Court pursuant to the Supreme Court Assignment Order.

Implied consent cases had to follow a similar process but without the need for a Written Notice of Consent to Assignment. The Supreme Court Assignment Order assigned all implied consent cases in which the Source Code Issue was raised. Such cases were identified by a party requesting discovery of the Source Code. The presiding judge hearing the discovery request had to determine whether such discovery was appropriate and issue a protective order for discovery to occur in accordance with the terms of the Consent Judgment and Permanent Injunction issued by Judge Frank. The requesting petitioner would have to submit a non-disclosure agreement executed by their retained Source Code expert and, following confirmation with a list developed and maintained by the Minnesota Attorney General's Office on behalf of the Commissioner of Public Safety, the matter would be added to a master list of implied consent cases assigned to this Court.[16]

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[15] Defendants and defense counsel oftentimes submitted a non-disclosure agreement and Written Notice of Consent to Assignment in conjunction with their request for discovery of the Source Code, particularly as the process became widely known and mainstream.

[16] Implied consent petitioners also sometimes submitted an executed non-disclosure agreement in conjunction with their discovery request, particularly as the process became widely known and mainstream.

Two master case lists identifying every individual case subject to the Supreme Court Assignment Order were created from these three processes.[17] Copies of these two lists are attached hereto as appendices and incorporated herein by reference. These are the individual cases which are directly subject to this Order. This does not limit other cases from agreeing to be bound, or actually being bound, by the results reached herein as a method of resolving that particular case. This Court is simply mindful of its responsibilities to protect the record and conduct proceedings in a fair and efficient manner.

Inquiry Pursuant to Rule 104 of the Minnesota Rules of Evidence

Throughout the proceedings of these assigned cases, this Court has made it clear that the inquiry being conducted is pursuant to Rule 104 of the Minnesota Rules of Evidence, which provides that "[p]reliminary questions concerning . . . the admissibility of evidence shall be determined by the court . . . ."

The charge posed to this Court by the Statewide Assignment Order was to resolve challenges to the accuracy and reliability of the test results obtained from Intoxilyzer 5000EN instruments based upon alleged defects in the Source Code. The question was whether the Source Code rendered the test results inadmissible because it somehow impacted the validity, accuracy, and reliability of the test results and thereby

[17] As part of the Court's case management, the decision was made to provide a cutoff date for which individual matters would be addressed at the evidentiary hearing ultimately commenced on December 8, 2010. The Court is aware the Supreme Court Assignment Order assigned all future criminal and implied consent matters raising the Source Code Issue in addition to those which were pending at the time the Order was issued. A matter of concern for this Court was the possibility that a criminal or implied consent case involving the Source Code Issue could arise shortly before the scheduled evidentiary hearing and the defendant or petitioner could follow the process to have their matter assigned and then seek a continuance on due process grounds to pursue some different approach than that followed in the matters already assigned. To avoid such an occurrence, a deadline for the addition of individual cases onto the docket for the evidentiary hearing commencing on December 8, 2010, was implemented. To the extent additional criminal or implied consent cases otherwise subject to the Supreme Court Assignment Order have arisen since that date and not been resolved indirectly as a result of these proceedings, the Court has provided further instruction herein.

deprived them of evidentiary value.

As preliminary proceedings pursuant to Rule 104, the outcome reached by this Court is not immediately dispositive of any single case that has been assigned. These proceedings instead provide resolution of a single narrow issue: the admissibility or inadmissibility of results reported by Minnesota's Intoxilyzer 5000EN fleet as a result of the Source Code of the instrument. This is not to say the conclusions reached by this Court may not result in cases being expediently resolved without any or with only minimal involvement of the courts in which these cases originally arose. In light of the conclusions reached herein, petitioners in implied consent proceedings may decide to waive their challenge to the Commissioner's license revocation or criminal defendants may elect to enter a plea or accept a plea agreement which was previously unacceptable. There may also be a small number of cases where the Commissioner is willing to withdraw the license revocation or the prosecutor is willing to dismiss the charges. All of these dispositive actions, however, must take place in the district courts from which the individual cases originally arose.

OPERATION OF SOURCE CODE IN MINNESOTA'S INTOXILYZER 5000EN

The Intoxilyzer 5000EN is a breath testing instrument which measures ethyl alcohol (ETOH), the type of alcohol typically found in alcoholic beverages. To perform this measurement, an Intoxilyzer 5000EN utilizes scientific methods and principles of measurement, hardware components, and software in a single integrated device. The device then also relies upon a very specific testing process. The sole purpose of this process and the device is to reliably obtain accurate and valid measurements of breath alcohol concentration for a subject providing a breath sample. To understand what

impact the operation of the Source Code within the Intoxilyzer 5000 EN has upon results which are typically admitted into evidence, a basic understanding of many of the functions of the instrument is necessary.

Scientific Methods and Principles of Measurement

The Intoxilyzer 5000EN utilizes an analytical method to quantitatively identify ethyl alcohol and other potential interferents and to quantify the concentration of ethyl alcohol present within a breath sample. The specific scientific method utilized is infrared absorption spectroscopy. To produce results which have evidentiary relevance, the Intoxilyzer 5000EN and its testing process must also utilize certain fundamental principles of measurement when seeking to quantify an unknown. These include accuracy, validity, and reliability.[18]

Basic Principles of Breath Alcohol Concentration Testing

The principles underlying the science and physiology of alcohol concentration measurement through a person's breath is beyond the scope of these proceedings. Such an inquiry would delve into areas of science and medicine which go far beyond an inquiry into the Source Code's impact upon the reliability of breath alcohol concentration results. Understanding the basics of such concepts, however, is necessary to understand the design of the Intoxilyzer 5000EN, to put into context arguments advanced by the parties in this case regarding those issues that are before the Court, and to provide an understanding for the Court's decision.

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[18] The implied consent petitioners and criminal defendants also raised the question of the Intoxilyzer 5000EN's ability to produce reliable results. This Court understands the term "reliable" as used by the implied consent petitioners and defendants to refer to the Intoxilyzer 5000EN's ability to repeatedly produce accurate and valid results for individual tests. The Court does not understand the use of the term "reliable" to be in reference to whether the scientific method of infrared absorption spectroscopy can produce admissible evidence under the "Frye-Mack" standard, a question which is beyond the scope of these proceedings.

The Intoxilyzer 5000EN was designed to operate off of a basic assumption which underlies breath alcohol concentration testing. This basic assumption is that "[t]here is a determinable ratio between the alcohol concentration in the blood (and the brain) and the alcohol concentration found in the breath." (Ex. 2, Bates p. 29.) The accepted ratio of the equilibrium between alcohol found in the alveolar (deep lung) air compared to that found in blood is 2100 to 1.[19] (Id. at Bates pp. 30 & 118.) This means that in 2100 parts of alveolar air, there is the same alcohol concentration as in one part of blood. (Id. at Bates p. 118). The basic assumption underlying breath alcohol testing requires the testing of alveolar air and is the alcohol concentration the Intoxilyzer 5000EN attempts to measure.

When testing the alcohol concentration of a person's breath, the desired sample is the alveolar air. As a person expels their breath, they first expel air located within the cavity of their mouth, then their esophagus, and finally their lungs. To reach the alveolar or deep lung air, a test subject must first expel the air in their mouth and esophagus. Once the alveolar air is reached, further exhalation will result in a measured alcohol concentration that gets closer to the equilibrium alcohol concentration of the alveolar air. The Intoxilyzer 5000EN attempts to reach this point of measuring alveolar air to produce its reported results.

In some cases, the measurement of alcohol concentration of alveolar air is

[19] The ratio of the equilibrium between alveolar air and blood of 2100 to 1 is incorporated into the statutory structure of Minnesota's driving while impaired offenses. Minnesota Statute § 169A.20, subdivisions 1(5), 1a(5), 1b(5), and 1c(5) criminalize driving, operating, or being in physical control of the identified vehicle within two hours of having a measured alcohol concentration of 0.08. Alcohol concentration is defined as having a number of grams of alcohol per 100 milliliters of blood and a number of grams of alcohol per 210 liters of breath. Minn. Stat. § 169A.03, subd. 2(1)-(2). There are 1000 milliliters in 1 liter. Therefore, a number of grams of alcohol in 210 liters of breath is equivalent to a number of grams of alcohol in 210,000 milliliters. Comparing this unit adjusted amount with the number of grams of alcohol per 100 milliliters results in a 2100 to 1 ratio of a number of grams of alcohol in the alveolar air to the same number of grams of alcohol in the blood.

further complicated by the presence of a high alcohol concentration within the mouth and esophagus, something typically referred to as "mouth alcohol." High concentrations of mouth alcohol can result in an initial measured alcohol concentration which is higher than that found in the test subject's alveolar air. As the test subject exhales further, the alveolar air begins to displace the air from their mouth and esophagus, and the breath alcohol concentration measurements return to a level typical of those obtained from test subjects who do not have a high mouth alcohol concentration. These concepts of the alveolar air equilibrium alcohol concentration, a typical breath alcohol concentration profile, and mouth alcohol concentration profile can be visually demonstrated as shown in Figure 1.

Figure 1: Representative Breath Alcohol Concentration Profiles

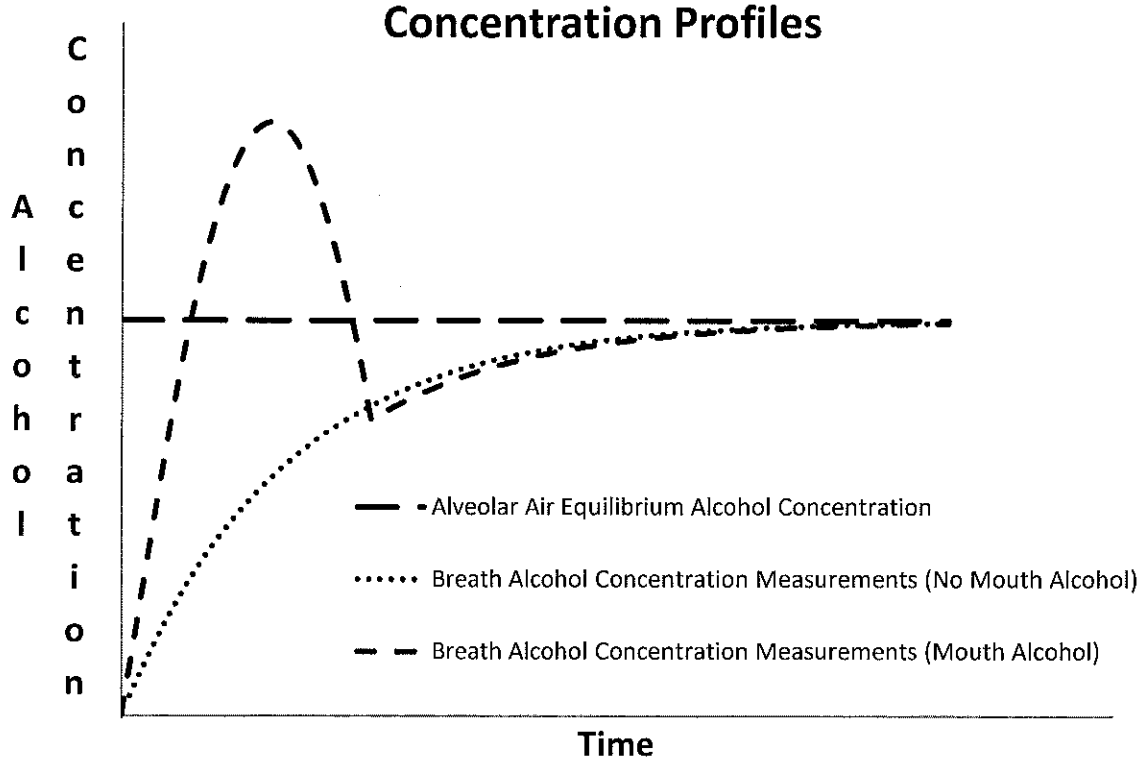

Figure 1[20] depicts representative breath alcohol concentration profiles, as described by witnesses from the Bureau of Criminal Apprehension ("BCA") over the course of a test subject's exhalation and an Intoxilyzer 5000EN test. The equilibrium alcohol concentration of the air in the test subject's alveoli, the deep lung air, is depicted in Figure 1 by a straight long dashed line marking a constant alcohol concentration. This equilibrium rate is what the Intoxilyzer 5000EN is attempting to measure over the course of the time allowed to run a breath test. It remains relatively constant over such a time frame.

The dotted line in Figure 1 represents a typical breath alcohol concentration measurement taken when a high concentration of mouth alcohol is not present. This profile depicts an increasing measured breath alcohol concentration which plateaus over time. As the test subject exhales, the mouth and esophagus air are expelled first.

Further exhalation gets to the alveolar air deeper in the lungs, which contains the unknown alcohol concentration that the Intoxilyzer 5000EN seeks to measure. As the air expelled by a test subject comes from deeper within their lungs, the measured alcohol concentration plateaus at or near the alveolar air equilibrium alcohol concentration. It is by measuring the alcohol concentration at such a point of the breath profile that the Intoxilyzer 5000EN seeks to measure the alcohol concentration of the alveolar air and thereby provide a meaningful alcohol concentration result.

The short dashed line depicts the initial alcohol concentration peak resulting from

[20] Figure 1 does not include any units or values for either axis, time or alcohol concentration. This is because the curves are representations of typical breath alcohol concentrations and do not depict any particular individual. The value of the alcohol concentration and time in any given case will be dependent upon the test subject providing the sample. This graphic depiction is a rough composite of the multiple similar graphs and testimony presented by various trial witnesses. See, e.g. Exhibits 46,53,56,57,59 and 60.Despite these graphic depictions, there is never a truly 'flat line' achieved in subject breath samples.

a high concentration of mouth alcohol. The initial alcohol concentration measurements taken from the beginning of a test subject's exhalation may be higher than the alveolar air equilibrium alcohol concentration when no mouth alcohol was present. As the test continues and the subject's exhalation proceeds, however, the air from the subject's mouth and esophagus are displaced from the instrument's sample chamber by air that originated deep in the subject's lungs. The result is in the measured alcohol concentration decreasing back to a curve similar to that when no mouth alcohol is present. The alcohol concentration would then increase as in the non-mouth alcohol curve until it plateaus at the alveolar air equilibrium alcohol concentration, the desired result.

Infrared Absorption Spectroscopy[21]

Infrared absorption spectroscopy is a scientific method of qualitatively identifying or quantitatively measuring a variety of compounds, including organic gases with low boiling points such as ethyl alcohol. (See Ex. 2, Bates pp. 20, 27; DOUGLAS A. SKOOG ET AL., PRINCIPLES OF INSTRUMENTAL ANALYSIS, 404-405 (Harcourt Brace & Co. 1998) (5th ed.) (hereinafter PRINCIPLES OF INSTRUMENTAL ANALYSIS). Generally speaking, this method works by irradiating a gaseous sample held within a particular temperature range with infrared light. (Ex. 2, Bates p. 20; L.G. WADE, JR., ORGANIC CHEMISTRY, 500-01 (Prentice Hall 1999) (4th ed.) (hereinafter ORGANIC CHEMISTRY).) The atoms and atomic bonds of molecules within the sample absorb the irradiating light at specific frequencies or wavelengths. (Id.; ORGANIC CHEMISTRY at 502-03.) The frequencies or wavelengths at which light is absorbed are dependent upon the structure of each

[21] Historically, there have been numerous methods used for measuring alcohol in breath samples. Infrared absorption breath testing devices have been commercially available since 1972. (Ex. 2, p. 23)

molecule. (Id.; ORGANIC CHEMISTRY at 503-05.) This enables differentiation of one molecule from another, including those with similar structure which could interfere with measurement of ethyl alcohol. Furthermore, the amount of the irradiating light which is absorbed by a specific molecule at a specific frequency or wavelength enables, according to the Beer-Lampert law, a quantification of the specific absorbing molecule. (Id.; PRINCIPLES OF INSTRUMENTAL ANALYSIS at 139-140.)

As a method of testing breath alcohol concentration, infrared absorption spectroscopy has been given a statutory presumption of trustworthiness and reliability in Minnesota. Minn. Stat. § 634.16, cited by Underdahl II, 767 N.W.2d at 685 n. 4. See also Kramer, 706 N.W.2d at 235-36; Rader, 597 N.W.2d at 323-24.

Principles of Measurement

When measuring an unknown sample, the principles of accuracy, validity, and reliability are paramount. Accuracy is how well an analytical instrument produces a close or tight grouping of results. This can be statistically represented, for example, through the use of a standard of deviation around an average. Validity is how well the instrument produces results which reflect the truth of the unknown being measured. Reliability is how well the instrument repeatedly produces accurate and valid results across all of the possible variables, including things like sample variability, environmental factors, and time. Accuracy and reliability can be determined fairly easily. Determining the validity of an instrument, however, can be difficult.

It is impossible to directly determine an analytical instrument's validity with respect to the true value of a subject sample. As noted above, the true value is unknown. Without this information, it is impossible to measure the difference between a

test result and the true value. Scientific measurement works around this problem by using an analogy. Measurement of a known value, often called a "control," or range of values, often called a "calibration curve,"[22] are taken under the same conditions as the subject sample. From this information, the validity can be determined because the difference in the measured value and the true value can be calculated. This rate of difference is then analogized to the measured values obtained when testing the unknown subject sample. The theory is that with everything being the same or nearly the same between the two tests, the calculated validity is also the same.

The Minnesota testing process – DABACABA -- utilized by the Intoxilyzer 5000EN addresses each of these principles to arrive at a result which provides information about the accuracy and validity of each test. The Intoxilyzer 5000EN also has a system in place called COBRA which allows for the collection of test data for every test. From this information, analyses can be conducted to examine aspects of the reliability of the instrument. This basic understanding of the scientific method and measurement principles used by the Intoxilyzer 5000EN provides the context for understanding the hardware and physical processes performed by the instrument to arrive at reported results.

Hardware and Physical Processes

A basic knowledge of the Intoxilyzer 5000EN's hardware and the physical processes it performs is necessary to understand the challenges to the reliability of test results obtained from the Intoxilyzer 5000EN. The physical configuration of the Intoxilyzer 5000EN and the component parts which make up the entire device were

[22] The known value or range of known values must also be near or around the expected value of the unknown value.

designed with the intent to accurately, validly, and reliably measure breath alcohol concentration of a human test subject by the infrared absorption spectroscopy method. The hardware present within the instrument combines with the pathways for gasses to follow, which are further oriented into specific test sequences to provide the operator with test results. The implied consent petitioners and criminal defendants have called into question various aspects of the hardware and testing processes in their case. A basic understanding of the hardware, gas pathways, and test sequences is therefore necessary to understand the criticisms of petitioners and defendants as well as this opinion.

Hardware of Intoxilyzer 5000EN

The Intoxilyzer 5000EN has a metal case which operates to assist in shielding the instrument's electronic components from radio frequency interference (RFI). Some of the hardware making up the Intoxilyzer 5000EN instrument can be observed from the exterior of the case, and some can only be observed by removing the case. From the outside of the casing, a breath simulator solution container and the breath sample tube may be observed. An RFI detection antenna and breath tube heater, which are the same wire, are also part of the breath sample tube which can be viewed from the outside of the casing. This combined heater and antenna plugs into the exterior of instrument via an RCA type connection. There is a single monochromatic digital display on the device, and peripherals such as a printer or computer keyboard may be, and typically are, attached to various data ports accessible on the exterior of the instrument. (See Ex. 166 – CFS Report, p. 13 (picture of the exterior of Intoxilyzer 5000EN).)

With the metal casing removed, the internal hardware can be physically

observed. (See Ex. 166– CFS Report, p. 17 (picture of interior of Intoxilyzer 5000EN).) The circuit boards, processors, EPROM, analog-to-digital converters (ADCs), digital-to-analog converters (DACs), wires, and all of the electronic components can be observed. A pressure transducer mounted in the path of the breath sample tube is also visible. This device operates with the processor and clock function of the device to measure pressure over time and thereby make a calculation of the breath volume delivered by a test subject. The sample chamber is also visible. With further disassembly, the infrared light source,[23] infrared filter wheel,[24] and infrared detector with its heat dissipation system can be observed. With even further disassembly, the air pump, which moves room air and the breath simulator solution through the instrument, can be seen.

Such are the primary hardware components of the Intoxilyzer 5000EN. With this hardware, the Intoxilyzer 5000EN utilizes three gas pathways to perform its three test sequences.

Gas Paths through Intoxilyzer 5000EN

The Intoxilyzer 5000EN has three physical paths for tested gasses to follow through the various hardware components of the instrument. One path is for breath samples of test subjects. The second path is for what is known as an "air blank." The final path is for the breath simulator solution. Each of these paths is unique, but they all share the use of some component parts throughout the instrument. Understanding how each path works and its purpose provides a basis for understanding the testing sequences which are run on an Intoxilyzer 5000EN instrument.

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[23] See Ex. 166 – CFS Report, p. 119 for a photograph of the light source.

[24] See Ex. 166 – CFS Report, pp. 117-18, 120-23 for photographs and technical specifications for the filter wheel and filters. The filter wheel is made up of five separate filters; one reference filter, two filters to measure ethyl alcohol and acetone, and two filters to measure possible interferents.

Air Blank Path

For the air blank path, the Intoxilyzer 5000EN draws room air through the instrument. (Ex. 2, Bates p. 21 (providing explanation and diagram of air blank path). The air pump turns on for eighteen seconds and thereby creates a pressure differential between the room air and the gas within the sample chamber. This causes room air to travel through the breath tube and into the sample chamber. The room air is then expelled through the pump and pump exit. As demonstrated by the path for the air blank, the purpose is to clear the breath tube and sample chamber. The Intoxilyzer 5000EN also uses the operation of this path to set a zero reference point based upon the room air present within the sample chamber. The actual process of setting this zero reference point and verifying the absence of ethyl alcohol or measured interferences within the room air is a Source Code function and is discussed more fully below. The air blank path process does not utilize the breath exhaust, the pressure transducer, the breath simulator solution, or any of the infrared source or detection hardware.

Breath Sample Path

The breath sample path also begins in the breath tube. (Ex. 2, Bates p. 23 (providing diagram of breath sample path). When a test subject provides a breath sample, they blow through the breath tube and into the sample chamber. When operating properly, the breath tube is heated to prevent the test subject's breath from condensing within the breath tube.

As the breath sample passes through the sample chamber, the infrared light source operates. The light from the infrared bulb passes through the test subject's breath and is focused onto a filter wheel, which only allows selected wavelengths or

frequencies of light to pass through. What specific wavelength or frequency of light is permitted through the filter wheel is dependent upon which of the Intoxilyzer 5000EN's five filters has spun into place at that specific instant in time. The permitted light which does pass through a filter is measured by the infrared detector. This measurement is conveyed to the instrument's processors, where the software performs calculations using the infrared detector measurements as they relate to each filter and reference information to calculate the amount of light absorbed by ethyl alcohol molecules within the test subject's breath in the sample chamber. Further calculation leads to the measured result of breath alcohol concentration. Because these calculations are performed by the software of the instrument, which is generated by the Source Code, a more complete discussion of the process is left for another section. The breath sample path does not utilize the air pump, air pump exit, or the breath simulator solution. Ultimately, the breath sample is expelled through the breath exhaust port on the back of the instrument.

Breath Simulator Solution Path

The breath simulator solution path is similar to the air blank path but with a few critical differences. The breath simulator solution path does not utilize the breath tube at all. Instead, the sample is drawn into the sample chamber from the simulator solution container through the simulator inlet. Like the air blank path, the air pump turns on for a specified time creating a pressure differential between the sample chamber and the simulator solution container. This pressure differential causes the simulator solution, a vaporized ethyl alcohol solution with a known concentration, to pass into the sample chamber, through the pump, and return to the simulator solution container. The ethyl

alcohol vapor for the simulator solution is not exhausted like the air blank or a test subject's breath sample because the known concentration of the simulator solution would decrease with each cycle of this path and the scientific value of measuring a known sample would be lost.

As the breath simulator solution is drawn through the sample chamber, measurements are taken of the alcohol concentration. The infrared source shines light through the sample chamber and onto the filters in the filter wheel. Light at the specified frequencies or wavelengths are allowed to pass through to the detector, where the amount of infrared light which was not absorbed by the ethyl alcohol molecules is detected by the detector. These measurements are then transmitted to the instrument's processor, which performs calculations to reach a resulting alcohol concentration of the simulator solution and confirm that the solution is within range of the known value. These calculations are performed according to the software of the instrument, so the specifics are left for another section.

Test Sequences of Intoxilyzer 5000EN

Minnesota's Intoxilyzer 5000ENs are capable of running three test sequences. These test sequences are denoted by the sample paths they utilize: ACA, ABA, or DABACABA. Each of the three sample paths may be used as part of a test sequence. In the test sequence used to obtain an evidentiary breath alcohol concentration of a test subject, DABACABA, all three of the sample paths are used. The other two test sequences only utilize two of the sample paths. In all sequences, the air blank sample path is utilized.

ACA

The ACA test sequence is a simulator test sequence. (Ex. 2, Bates p. 62.) It is comprised of a diagnostic cycle,[25] an air blank cycle, a breath simulator solution cycle or control, and another air blank cycle. This test sequence must be run when a new simulator solution is substituted for an old solution. Each breath simulator solution may be used for 31 days or 150 sample sequences, whichever occurs first. The solution must then be changed before any further test subject samples may be run. Operators change the existing solution by physically changing the solution containers and then running the ACA test sequence. As part of the ACA test sequence, the operator has to enter the solution number and the simulated breath alcohol concentration contained on the label for the new simulator solution. If the result obtained by an Intoxilyzer 5000EN for the new simulator solution is not within 0.010 of the value entered, then the instrument will be disabled until a new simulator solution is added.

ABA

The ABA test sequence is an informal, short-form version of the evidentiary test sequence. It is not used to obtain results which are admitted into evidence but is used instead for more informal purposes, including screening for probation or parole violations of a no-use-of-alcohol condition; testing juveniles when the presence of consumed alcohol is important but the actual alcohol concentration is not; and informally demonstrating or testing the instrument's measurement capabilities. This test sequence is of limited use because it does not include a cycle for the breath simulator solution or a second breath sample. Instead, the ABA sequence consists of an internal diagnostic

[25] When the Intoxilyzer 5000EN performs an internal diagnostic cycle, it checks the EPROM, RAM sample cell temperature, several items on the processor board, printer, clock, an internal standard, and the status of the simulator solution. (Ex. 2, Bates p. 126.)

cycle, an air blank cycle, a single breath sample cycle,[26] and a second air blank cycle. It also relies solely upon a paper record for retention of the results obtained. If the operator elects not to make a printout of the test sequence run, then the results are not retained in the COBRA system or in any other way by the instrument. The ABA sequence, however, is faster than the evidentiary test sequence, DABACABA, and does not utilize the breath simulator solution and therefore does not diminish the 150 sample sequence limit. The ABA sequence is simply a quick and informal means of qualitatively identifying the presence of ethyl alcohol without focusing on the principles of accuracy, validity, or reliability.[27] In contrast, the DABACABA sequence does focus on accuracy, validity, and reliability.

DABACABA

The DABACABA sequence is the full breath alcohol concentration test sequence used by operators to obtain test results which are then offered into evidence. Results obtained from this test sequence are also those which are given a statutory presumption of trustworthiness and reliability in Minnesota. See Minn. Stat. § 634.16, cited by Underdahl II, 767 N.W.2d at 685 n. 4; Minn. R. 7502.0430, subp. 1 (requiring two breath samples in the sequence of breath, standard, breath). The DABACABA test sequence consists of an internal diagnostic, an air blank cycle, a breath sample cycle, another air

[26] A single breath sample cycle includes a replicated test of the same sample. The DABACABA sequence, in contrast to the ABA sequence, also includes a second full breath sample cycle. This means the DABACABA sequence actually records four alcohol concentration results, two from each breath sample, whereas the ABA sequence only records two alcohol concentration results from one breath sample.

[27] This is not to say the ABA sequence does not provide accurate, valid, and reliable results. The sequence itself, however, simply does not include the processes, measurements, or data collection which would allow conclusions to be drawn regarding the accuracy, validity, and reliability of results obtained with this test sequence.

blank cycle, a breath simulator solution or control cycle,[28] an air blank cycle, a second breath sample cycle, and a final air blank cycle. It is this test sequence which incorporates processes that allow for conclusions to be drawn regarding accuracy, validity, and reliability.

Testing two separate breath samples from a test subject allows for a scientific conclusion about the accuracy of a test to be drawn from the results obtained. The DABACABA sequence obtains two breath samples from a test subject. Two measurements of each of these samples are taken, for a total of four breath alcohol measurements. By taking two breath samples, the DABACABA sequence generates two independent measurements of the unknown being measured. The variability between these results provides information about the instrument's measurement accuracy across test samples. The variability between the two measurements of each breath sample provides similar but slightly different information. The focus is upon the instrument's measurement accuracy of a single sample. By making these replicate measurements, the DABACABA sequence obtains information which allows a calculation of whether the desired accuracy was obtained.[29] The software of Minnesota's Intoxilyzer 5000ENs makes this calculation in reference to a preset limit upon the accuracy in determining whether to report a result. Consequently, further discussion is provided in a subsequent section which specifically addresses the software operation and sample acceptance.

In addition to obtaining information about the accuracy of a test, the DABACABA

[28] The breath simulator solution or control cycle is referred to in Minnesota Rule 7502.0430 as a standard.
[29] There are obvious conclusions that are instantly drawn by reason of the ability to compare four results obtained very close in time as to accuracy.

sequence also obtains measurements from which validity of a test can be inferred. The testing of the breath simulator solution, also referred to as a "control" or a "standard," provides a known alcohol concentration against which measurements can be compared. This comparison of a known alcohol concentration against measurements of the known made by the instrument provides information about the validity of the test; specifically, the validity of the testing for the breath simulator solution. By running the testing of the breath simulator solution and test subject breath samples under identical or nearly identical parameters, the inference can be made that the validity for the test subject's breath samples is the same as the validity for the breath simulator solution.[30] The Intoxilyzer 5000EN's software performs the necessary calculations utilizing this inference and compares the result to a predetermined acceptable limit of variability. The outcome of this comparison then influences sample acceptability and is discussed further in the next section.

Finally, the DABACABA test sequence utilizes a data collection system called COBRA, Computer Online Breath Archiving, to obtain information about the reliability of Minnesota's Intoxilyzer 5000EN fleet. With the COBRA system, the BCA is able to monitor and perform calculations upon the accuracy and validity data obtained from every test performed on an Intoxilyzer 5000EN in Minnesota for evidentiary purposes. It is this information which is necessary to draw conclusions about the reliability of individual instruments or the Intoxilyzer 5000EN fleet as a whole.

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[30] As discussed previously, this inference is made because it is impossible to directly determine the validity of measurements made upon an unknown. Without knowledge of the true value, such an analysis cannot be performed. It should be noted that the Minnesota BCA used other inferential methods in validating the Intoxilyzer 5000EN instrument and various software versions for use in Minnesota. These methods include comparison of Intoxilyzer 5000EN measurements to measurements obtained through other methods of analysis like blood or urine testing. Such methods utilize the same inference but rely upon a slightly different assumption, the validity of the alternate testing methods.

The DABACABA test sequence is a scientific measurement process designed to obtain information about the accuracy, validity, and reliability of tests run on Minnesota's Intoxilyzer 5000ENs. The focus in this case, however, is not upon the proprieties of this scientific process or the limits by which acceptable accuracy and validity are determined. The specific issue being addressed in these proceedings is narrower. The present inquiry is limited to how the Source Code of these instruments impacts the accuracy and validity of individual tests and if some portion of the Source Code interacts with the hardware or scientific principles such that a test result is unreliable and inadmissible as evidence. In order to answer such questions, the role of the Source Code in the operation of the Intoxilyzer 5000EN must be explained.

Source Code and Role Served in Intoxilyzer 5000EN

Source code is a human-readable representation of instructions that are performed by a computer. The Source Code for the Intoxilyzer 5000EN is over 1,113 pages of printed material.[31] It is comprised of C code and Assembly code for the two microprocessors used in the Intoxilyzer 5000EN, the 8051 processor (referred to as the Slave processor), and the Z80 processor (referred to as the Master processor). When this code is compiled or assembled and linked, it is converted into a form which is executable by the microprocessors. It is this converted form which is actually burned on EPROMs that are then installed on the microprocessor circuit boards, from which the processors obtain their instructions in the course of operating the instrument.

The processors execute the instructions contained in the converted Source Code to perform the instrument functions. The Master processor is responsible for the basic

[31] Of the hardbound copy of the Source Code, about 960 pages are code for the Master processor (Z80), while the remaining approximately 150 pages are for the Slave processor (8051).

instrument operations like buttons, displaying readouts, the printer interface, the hardware interface, sounding a tone indicating a subject should blow into the instrument, and general housekeeping matters. The Slave processor is primarily responsible for receiving the analog output or measurements and performs most of the calculation or data analysis, including a determination of sample acceptance. The aspects of software function performed by the Slave processor are those which are particularly relevant to these proceedings. The interaction of the Slave processor with the Master processor also has some relevance because of the interaction between the Master processor's function and the test subject and the Master processor's responsibility to report the calculated sample measurements.

The existence of dual processors in the Intoxilyzer 5000EN is inherent to its operation. The Master processor (Z80) used in the Intoxilyzer 5000EN is a product that was originally developed in the 1980s. The Slave processor in the Intoxilyzer 5000EN frees up the Master processor to perform the more basic functions of the instrument. To accomplish this goal, the more intensive processor functions are offloaded from the Master processor to the Slave. This appears to be an attempt by CMI to obtain greater functionality from the Intoxilyzer. Regardless of the reason for the dual processors, the software within the instrument that arises from the Source Code is responsible for directing the instrument to perform certain functions in response to input from the operator or test subject. The Source Code for the Master processor is primarily responsible for minor process functions of the instrument, whereas the Source Code for the Slave is primarily responsible for the data collection and analysis, which is the focus of these proceedings.

Air Blank Data Collection and Calculation

As part of the DABACABA test sequence performed by the Intoxilyzer 5000EN, several air blank samples are run through the instrument. An alcohol concentration measurement is taken by the Intoxilyzer 5000EN for each air blank. The purpose of this measurement is to confirm that the sample chamber does not contain alcohol prior to and after the test subject's breath sample and the breath simulator solution sample. If the instrument initially detects that the sample chamber has alcohol inside at the beginning of the air blank cycle and the operation of the air blank cycle does not reduce this measurement to below 0.017, then a purge fail error will be reported and the test cycle will terminate. (Ex. 2, Bates p. 74.) If the instrument detects a 0.000 alcohol concentration during the air blank cycle which then increases to some measureable alcohol concentration, then an ambient fail error will be reported and the test would likewise be stopped. (Ex. 2, Bates p. 69.) This comparative analysis and error reporting of the measurements being made by the Intoxilyzer 5000EN's hardware to a 0.000 reference point is performed by the operative version of the Source Code.

In some circumstances, the Source Code does more than a simple comparative analysis and error code reporting. The Intoxilyzer 5000EN stores a reference point for a 0.000 alcohol concentration. This reference point is obtained by assigning an analog signal received from the infrared detector the digital value of 0.000. Future measurements taken of air blanks are compared to this stored analog signal, and an adjustment of the stored value is made if the air blank results in a measured alcohol concentration between 0.000 and 0.017. For example, if measurement during an air blank cycle results in an alcohol concentration of 0.014, the Source Code would

automatically set this analog signal strength as the new reference by assigning it a digital value of 0.000. Unlike the error codes for measured alcohol concentrations at or above 0.017, this adjustment is made without any record. No message, reported error, or printed test result is generated. The implied consent petitioners and criminal defendants have cited this "silent adjustment" as potential error created by operation of the Source Code. This argument is addressed in greater detail in a later section. However, it is important to note that the calculation performed by the Source Code on the control data provides some assurance that such an adjustment will not impute error into the breath sample results.

Control Data Collection and Calculation

The breath simulator solution, referred to as a "control," is also measured during the DABACABA test sequence. The Intoxilyzer 5000EN takes measurements as the breath simulator solution is run through the sample chamber. The two results obtained from these measurements are compared to the known alcohol concentration value included with the control solution. This comparison, which is performed by the Intoxilyzer 5000EN software, must result in a difference of less than 0.010. If it does not, then a control fail error will be reported by the Intoxilyzer 5000EN and no test subject results can be obtained. (Ex. 2, Bates p. 70.)

Sample Data Collection

The software or Source Code of the Intoxilyzer 5000EN is also involved in the collection of sample data from the breath sample cycles of the DABACABA sequence. When the DABACABA sequence is run on an Intoxilyzer, the Master processor's software causes an audible tone to sound and a "Please Blow" instruction to appear

upon the display during the breath test sample cycle of the sequence. This indicates a test subject should blow into the breath tube. As a test subject provides a sample, pressure and alcohol concentration measurements are simultaneously taken and collected by the software for the Slave processor.

The flow rate and total volume of the test subject's breath sample are calculated from pressure measurements made by the pressure transducer and information from the instrument's internal clock. The pressure transducer can measure pressure at a particular point in time. This information is collected and stored by the Intoxilyzer 5000EN's software. At the same time, information from the internal clock is also collected and stored by the Intoxilyzer 5000EN. The pressure and correlated time measurements are used by the software to calculate total volume and flow rate. This calculation involves mathematical computation in accordance with formulas relating pressure, volume, and time to one another. These relationships also involve variables such as temperature, which are controlled by the instrument. The calculated flow rate and total volume values are then used by the Slave processor to perform additional sample acceptance analysis.

Alcohol concentration measurements are also taken and stored by the software for ultimate use in the sample acceptance analysis. Alcohol concentration measurements of up to thirty values are collected and stored at any given time. A mathematical computation is performed upon sets of thirty measurement values to produce an averaged result. As further measurements are taken, the averaged result is updated. Following the first thirty measurements, the software recalculates the averaged result by combining the last twenty-three measurements used to calculate the

prior averaged result with seven new measurements. This cycle of discarding the oldest seven measurements and recalculating the average based upon the most recent thirty measurements continues until a sample is no longer provided. These averaged alcohol concentration measurements are further analyzed by the software of the Slave processor to determine sample acceptance and thereby decide upon a further course of action.

Sample Acceptance Criteria

The Minnesota version of software for the Slave processor of the Intoxilyzer 5000EN utilizes calculated flow rates, calculated volume, the averaged alcohol concentration data, and time measurements to perform a sample acceptance analysis. Five separate criteria must be met within a four-minute timeframe for a test subject's breath sample to be accepted by the Intoxilyzer 5000EN. These criteria include a (1) minimum initial flow rate, (2) minimum continuing flow rate, (3) minimum total volume, (4) consistent slope, and (5) minimum time. Each of these criteria serves a critical purpose and must be met for the instrument to properly provide an accurate and valid breath alcohol concentration measurement. The contents of a test record printed by an Intoxilyzer 5000EN are dependent upon the software's sample acceptance analysis.

Flow Rate

The Master processor software analyzes the calculated flow rates to determine compliance with two of the sample acceptance criteria: the minimum initial flow rate and the continuing flow rate. The Intoxilyzer 5000EN requires a minimum initial flow rate of 0.17 liters per second. Once this value is met, the Master processor's software begins calculating the total volume. A flow rate of 0.15 liters per second must be maintained

while each of the three remaining criteria is met. If the flow rate drops below the threshold of 0.15 liters per second, then the calculation of total volume must begin anew. Such an occurrence also results in an increase of the puff counter value reported on a test record.

Two Source Code Modules operate together to determine whether the pressure being measured meets the minimum initial and minimum continuing flow rate criteria. As a breath sample passes the pressure transducer, analog measurements are taken. The signals representing these measurements are passed through an analog-to-digital converter and then conveyed to the first Source Code Module, which applies a calibration constant and averages the readings.[32] The pressure outputs from the first Source Code Module are transmitted to the second Source Code Module, which applies a calibration constant to convert the pressure measurements into a flow rate. The output from this second Source Code Module, in the form of a calculated flow rate, is then used to calculate total volume and determine whether the threshold flow rates are met.

The calculated flow rates are not directly reported by the Intoxilyzer 5000EN. Instead, the instrument reports a puff count value, which is a product of the two flow rate criteria. Once the minimum initial flow rate of 0.17 liters per second is detected, the puff counter will obtain a value of at least one. With each drop in the continuous flow rate below 0.15 liters per second and return back above 0.17 liters per second, the puff

[32] The calibration of the pressure transducer and subsequent flow rate and volume calculations are checked by using a medically certified spirometer to pass three air samples of 3 liters each at flow rates of approximately 0.25 liters per second, 0.35 liters per second, and 0.45 liters per second over the pressure transducer. The instrument's measured total volume must be within 5% of 3 liters to pass this certification test. This explanation was provided by Mr. Pulju.

count is increased in value by one.[33] For example, a puff count of four would generally be indicative of four cycles wherein the measured flow rate met the 0.17 liter per second threshold but then fell below the continuous flow rate threshold of 0.15 liters per second before the other sample acceptance criteria were met. Under one set of circumstances, however, the puff count is erroneously reported.

The BCA acknowledges and it is widely recognized that the Intoxilyzer 5000EN's software inexplicably doubles the puff count value under a specific set of circumstances. When a breath sample provided by a test subject fails to meet the slope check criterion but meets the other four sample acceptance criteria, then the calculated puff count value is doubled before it is reported. There is no explanation for this doubling of the calculated puff count value, scientific or otherwise. An error in the Source Code causes the puff count value calculated from the changing flow rate to double. In all other circumstances, the puff count value reported by the instrument accurately reflects the number of instances when the calculated flow rate met or exceeded the minimum initial rate of 0.17 liters per second.

Volume

The third criterion used by the Intoxilyzer 5000EN to determine sample acceptance is a minimum total volume. Once the initial minimum flow rate is met, the Source Code begins calculating a total volume from the calculated flow rate. For a sample to be accepted, the instrument requires the calculated total volume to exceed 1.1 liters. This requirement serves to ensure the desired deeper lung air is being

[33] The operative event for the software to increase the puff count value is the drop in calculated continuous flow rate of 0.15 liters per second, not the rise above an initial flow rate of 0.17 liters per second. Practically speaking, however, a drop in calculated continuous flow below 0.15 liters per second may only occur if the initial flow rate exceeds 0.17 liters per second.

measured by the instrument without making the minimum sample volume criterion too stringent.

The Source Code for the Master processor calculates the total volume. Specifically, the second Source Code Module which calculates the flow rate from the measured pressure also calculates the volume. When the instrument detects that the minimum initial flow rate of 0.17 liters per second has been met, it begins measuring the time interval of the breath or puff. Generally speaking, a flow rate is simply a reflection of volume passing a certain point over a period of time. The Intoxilyzer 5000EN takes advantage of this relationship by combining the time measurement with the calculated flow rate to calculate a total volume. As long as the calculated total volume exceeds 1.1 liters, the minimum total volume criterion will be met and the instrument may accept the BrAC results obtained from the sample.

The 1.1 liter total volume threshold was selected by the BCA. The purpose of a minimum total volume threshold is to ensure it is deeper lung air which is being measured. The volume threshold also helps prevent erroneous measurement of mouth alcohol. The greater the minimum volume threshold, the more likely it is that the measured BrAC is from the test subject's deep lung air and is not a product of alcohol present in their mouth. Ensuring the measured BrAC is from the deep lung air, however, must be balanced against having a minimum volume which can be expelled from the lungs of test subjects. As the required minimum total volume is increased, the ability of some portion of the driving population to provide an acceptable sample will be reduced. Some individuals would simply lack an adequate breath volume in a single puff to meet the threshold. In balancing these considerations, according to one of its

witnesses, the BCA selected 1.1 liters because it was the breath volume criteria used to determine eligibility for a handicap parking permit in Minnesota.

Slope Check

The fourth sample acceptance requirement considered by the Source Code in determining whether to accept or reject a sample is the slope check. The Intoxilyzer 5000EN makes continual measurements of the alcohol concentration of the breath sample in the instrument's sample chamber. Plotting these results on a graph would result in curves similar to the examples shown in Figure 1. The instrument uses a slope check feature to determine when the measured alcohol concentration is reaching a level slope or nearing the equilibrium alcohol concentration. The slope check feature is a product of the Source Code of the instrument's Slave processor.

The Intoxilyzer 5000EN measures the alcohol concentration in the instrument's sample chamber about 40 times per second.[34] The Source Code takes these measurements and calculates an average alcohol concentration. The first 30 measurements are averaged to obtain the first averaged alcohol concentration. Subsequent averaged alcohol concentrations are calculated by averaging seven new measurements with the twenty-three immediately preceding measurements. Each successive averaged alcohol concentration data point is therefore a combination of measurements used to calculate the prior data point and new measurements. The result is a moving average of data points that the Source Code uses to calculate a slope

[34] The speed of the instrument's measurement of alcohol concentration is a result of the speed of the infrared filter motor. The infrared filter is spun by a motor at a speed of approximately 2,400 revolutions per minute or approximately 40 revolutions per second. The instrument obtains a single alcohol concentration measurement for each revolution.

and determine slope acceptance.[35] Due to limitations of the microprocessors and calculation burdens placed upon them by other features of the Source Code, such as interferent detection, the software contained in version 75_240 may reject samples depending on how hard the subject blows.

The Source Code uses the averaged alcohol concentration data points to calculate a slope or percent change from one averaged point to the next. This change in slope must be less than or equal to 7% for an averaged alcohol concentration to be accepted and reported as a result. If the slope is changing by some amount greater than 7%, then the Intoxilyzer 5000EN continues to measure the alcohol concentration and calculate averaged data points. The Source Code will continue to check whether the slope is less than or equal to 7% until a sample is accepted, the minimum continuing flow rate drops below 0.15 liters per second, which would reset the other sample acceptance criteria, or the maximum time limit of four minutes is reached. Samples which never pass the slope check will result in the Intoxilyzer reporting a "Deficient Sample" rather than a BrAC result.

Once an averaged alcohol concentration result is accepted, the Intoxilyzer 5000EN stops taking measurements and ceases the breath sample cycle. This final averaged alcohol concentration is accepted because all of the sample acceptance criteria have been met, and this will be the reported result. The Intoxilyzer 5000EN reports results by generating a printout of the entire test sequence.[36] Along with the

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[35] CMI has developed other methods of calculating average alcohol concentration for other clients, including Norway. The method used by Minnesota's Intoxilyzer 5000EN fleet, however, is that described herein.

[36] The Intoxilyzer 5000EN also displays the current averaged alcohol concentration result on a display. Sometimes the Source Code process updating this displayed result is interrupted by the acceptance of an averaged alcohol concentration result and cessation of the breath sample cycle. This may result in the final accepted BrAC result reported on the printout being slightly different than the result last seen on the

accepted average alcohol concentration, the instrument also reports the calculated total volume, which corresponds only to the breath or puff which resulted in an accepted average alcohol concentration. The other underlying measurements and averaged alcohol concentration data points are not reported in any fashion.[37]

Time

The final criterion for sample acceptance is a time requirement. The Intoxilyzer 5000EN must have at least ten averaged alcohol concentration data points to report a BrAC result. It takes the instrument approximately two seconds to obtain sufficient measurement results to calculate ten average alcohol concentration data points. Practically speaking, however, nearly every test subject will meet the two-second time requirement because it will take them at least that long to expel 1.1 liters of breath into the instrument.

There is also a maximum time limit placed upon the test subject. The Intoxilyzer 5000EN has a four-minute time limit for each breath sample cycle. This means that the test subject must provide a sample which meets all of the sample acceptance criteria within four minutes to have a reportable BrAC result. An audible tone is made by the Intoxilyzer 5000EN to indicate to a test subject that they should continue blowing into the instrument. The tone continues until all of the sample acceptance criteria are met. If no alcohol has been detected and all of the criteria have been met, the tone ceases and a BrAC of 0.000 is accepted and reported by instrument. If some concentration of alcohol has been detected, then the tone continues and the Source Code of the

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display. The difference should only be ± 0.001 grams per 210 liters. Regardless of whether this occurs, the final accepted averaged alcohol concentration is always reported on the printed test record.

[37] CMI has apparently developed Source Code which enables a graphical printout of the alcohol concentration data points. This feature, however, has not been enabled in the Minnesota version of the Source Code.

instrument checks for compliance with the slope check requirement. If the slope check requirement is not met, or any of the sample acceptance criteria remain unmet throughout the four-minute time frame, the instrument will report an error code rather than a BrAC result.

Additional Selected Error Codes

The Intoxilyzer 5000EN may produce a result in the form of an error code rather than providing a BrAC result. These error codes indicate some problem with the instrument, sample, or test. When reported, these error codes prevent the instrument from providing a BrAC result which may be inaccurate, invalid, or unreliable for some reason. The error codes generally fall into three categories: (1) problems with the instrument; (2) issues with the sample; and/or (3) analysis of the results. This discussion is not an exhaustive review of all of the possible error codes but instead highlights those which are germane to the points made during these proceedings.[38]

Instrument Problems

The Intoxilyzer 5000EN checks several aspects of the instrument throughout its operation. Many of these involve communication between the Intoxilyzer 5000EN and various attached peripheral devices like the printer or Guth simulator.[39] They also involve checks or reporting of information received from the Intoxilyzer 5000EN's hardware such as the clock, RFI detector, and the pressure transducer. The error

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[38] The Court was never provided with a comprehensive list of the possible error codes. However, the Department of Public Safety and BCA's Breath Test Operator Training Course Manual does contain a partial listing of screen and print messages used by the Intoxilyzer 5000EN. (See Ex. 2, Bates pp. 69-76.)

[39] The Breath Test Operator Training Course Manual identifies the following instrument problem error codes: CLOCK ERROR; NO RESPONSE FROM SIMULATOR; NOT READY; OUT OF PAPER; PRINTER ERROR/PRINTER OFFLINE; PROM FAIL; RANGE ERROR; RAM FAIL; SIM SOLUT FAIL; SIMULATOR REPORTS AN ERROR CONDITION; SIMULATOR TEMPERATURE NOT IN TOLERANCE; STABILITY FAIL; TEMP FAIL; UNSTABLE REFERENCE; 15 ENOUGH MEMORY; and 29.56 C, H-1 M-1.

codes reflecting an instrument problem which are particularly relevant to these proceedings are "Inhibited RFI" and "Improper Sample."

The "Inhibited RFI" error code is reported when the Intoxilyzer 5000EN's RFI detection system reports the presence of RFI and ends a test. The Intoxilyzer 5000EN passively detects RFI. When RFI exceeding a certain threshold is detected, the sample sequence is terminated and the Inhibited RFI code is reported. As a response to this error code, operators administering breath tests are instructed to "[t]urn radios and cell phones off [and b]egin another subject test." (Ex. 2, Bates p. 72.) The Source Code for the Intoxilyzer 5000EN would not allow a test to be completed under any circumstances if the threshold level for RFI is exceeded.

As part of these proceedings, the parties also presented evidence about the Improper Sample error code reported by the Intoxilyzer 5000EN. The primary purpose of this evidence was to differentiate the "Improper Sample" error code from the "Invalid Sample" and "Deficient Sample" error codes which are discussed further in the next section. For the purpose of these proceedings, simply explained, the "Improper Sample" error code occurs when the instrument detects air being blown into the breath tube when a breath sample has not been requested by the instrument.

Sampling Issues

The Intoxilyzer 5000EN monitors the full sample sequence, DABACABA, for issues with air blank, control and breath samples.[40] The error codes which identify problems with the air blank and control samples were discussed previously in the above sections which address the air blank and control data collection and calculation.

[40] The Intoxilyzer 5000EN will also report error code "CH 0 3489 xxxx," where the "xxxx" may vary, if the instrument fails the diagnostic check due to a stability issue. (See Ex. 2, Bates p. 70.)

Several other error codes are reported by the Source Code of the instrument when various problems occur with the breath sample portion of the full sample sequence. These error codes include identification of interferents, an unexpected decrease in the measured alcohol concentration, or failure of breath sample to meet the sample acceptance criteria.

The current version of the Slave software includes an interferent detection process. As part of this process, the instrument identifies compounds with molecular structures similar to that of ethyl alcohol that interfere with the BrAC measurement. If an interferent is detected in concentrations above a threshold level, then the instrument reports one of two error codes. When the interferent is identified as acetone, the Intoxilyzer 5000EN reports the "Acetone Subtracted – Offer Alternate Test" error code. For all other interferents, the Intoxilyzer 5000EN reports the "Interferent Detected – Offer Alternate Test" error code. Regardless of the error code reported, operators administering breath tests are directed to collect a blood or urine test. (See Ex. 2, Bates pp. 69, 72.)

The Source Code also monitors breath samples for unexpected decreases in the measured alcohol concentration and reports an error code if detected. The testing model utilized by the Intoxilyzer 5000EN is premised upon an expected breath alcohol concentration curve which has an increasing alcohol concentration that approaches a plateau at the alveolar air equilibrium alcohol concentration. See Fig. 1 (the line for the Breath Alcohol Concentration Measurements (No Mouth Alcohol) is reflective of this concept). When a significant deviation from this expected trend is measured, it raises a concern that what is being measured is actually the presence of "mouth alcohol, burps,

belches, vomiting or sucking air back through the mouthpiece" rather than the deep lung air alcohol concentration. (Ex. 2, Bates p. 72.) The instrument reports an "Invalid Sample" error code when the measured alcohol concentration decreases by 0.006 or more during a breath sample. (Id.) The Intoxilyzer 5000EN does not collect any information regarding why the unexpected decrease in alcohol concentration occurred nor does the Source Code perform any analysis upon the data obtained to generate such a conclusion. In response to this error code, operators administering breath tests are instructed to "[s]tart another test after completing an additional observation period if needed." (Id.)

In addition to monitoring unexpected decreases in measured alcohol concentration, the Intoxilyzer 5000EN reports an error code when some of the sample acceptance criteria are not met. When the instrument does not detect a breath sample which meets the minimum breath volume of 1.1 liters and the slope check within four-minute time limit, a "Deficient Sample" error code is reported. This error code does not identify which of these two criteria were not met. In some circumstances, a "Deficient Sample No Sample Given" error code would be substituted for the "Deficient Sample" code because the instrument never recorded a minimum flow rate 0.17 liters per second. In either case, the instrument does not identify the cause or reason for the failure to meet the acceptance criteria. According to the reviewing experts, the Intoxilyzer 5000EN is actually incapable of identifying a cause or reason. The instrument only "knows," through operation of its Source Code, that the criteria were not met. Stated alternatively, the reason(s) for the deficiency in the sample lack granularity.

Analysis of the Results

The Intoxilyzer 5000EN does very little analysis of the BrAC results it reports. The limited analysis that is done is performed by the Source Code. It simply calculates the difference between the highest and lowest reported BrAC results and checks to see if this difference is greater than 0.020. When the difference is less than or equal to 0.020, the lowest truncated result is reported as the BrAC. Variability of greater than 0.020 results in the Intoxilyzer reporting "Deficient Test .02 Agreement Not Met – Administer Second Test." In response to this error code, operators are directed to run another full test sequence, DABACABA. If the difference between the highest and lowest reported BrAC results is also greater than 0.020 on the second test sequence, the Intoxilyzer 5000EN provides the modified "Deficient Test – Refusal" error code. Operators are informed that the reporting of this second "Deficient Test" error code "constitutes a refusal." (Ex. 2, Bate p. 71.)

The requirement for 0.020 or less agreement between the highest and lowest reported BrAC results comes from legislative enactment of Minnesota Statute § 169A.51, subdivision 5(d)-(f) in 2003. See S.F. No. 1158, 83rd Leg., Reg. Sess., § 3 (Minn. 2003) (signed by the Governor on May 25, 2003). Subdivision 5(d)-(f) provide:

> (d) For purposes of section 169A.52 (revocation of license for test failure or refusal), when a test is administered using an infrared or other approved breath-testing instrument, *a breath test consisting of two separate, adequate breath samples within 0.02 alcohol concentration is acceptable. A breath test consisting of two separate, adequate breath samples failing to meet this criterion is deficient.*
> (e) *If the first breath test is deficient*, as defined by paragraph (d), *a second breath test must be administered.*
> (f) *Two deficient breath tests*, as defined by paragraph (d), *constitute a refusal.*

Minn. Stat. § 169A.51, subd. 5(d)-(f) (2010) (emphasis added).[41] The 0.020 agreement check and "Deficient Test" error codes were added to the Intoxilyzer 5000EN Source Code by CMI at the request of the State of Minnesota following enactment of subdivision 5(d)-(f). The instrument does not obtain any information about why the highest and lowest BrAC results are more than 0.020 apart or perform any additional analysis. The Source Code just follows the process set forth in the statute. The nature of the error codes reported by the Intoxilyzer 5000EN forms, in part, the Court's conclusions about the Source Code's impact upon reported results.

[41] There are currently no published opinions from the Minnesota Appellate Courts regarding this 0.020 agreement check and its attendant consequences. See 31 Douglas V. Hazleton, Minnesota Practice – Minnesota DWI Handbook § 16:11 (2010).

The Evidentiary Hearing

Testimony in this case began on December 8, 2010, and concluded on December 23, 2010. Eight witnesses testified at the hearing. A total of 51 exhibits were received by the Court. At the parties' request, final submissions were presented to the Court simultaneously in writing on January 31, 2011, when the Court took this matter under advisement.

The hearing was conducted expressly under Minnesota Rules of Evidence, Rule 104. Despite there being numerous references to individual requests for a Frye-Mack hearing, the issue as framed by Justice Magnuson, as well as set forth in State v. Brunner, is one of threshold admissibility. In other words, whether challenges related to the reliability of Intoxilyzer 5000EN results based on the Source Code of the instrument should be permitted. [...analysis of the Source Code may reveal deficiencies that could challenge the reliability of the Intoxilyzer and, in turn, would relate to [Brunner's] guilt or innocence.] (Brunner @ 686). This Court reminded counsel on several occasions during these proceedings and the evidentiary hearing that this process is not a collateral attack on Minn. Stat. 634.16, or existing law, e.g. State v. Birk, 687 N.W.2d 634 (Minn. App. 2004); State v. Rader, 597 N.W.2d 321, 323 (Minn. App. 1999). Rather, the hearing was to enable a critical analysis and review of the Source Code by those who made a *prima facie* showing of the need to do so. This Consolidated Source Code proceeding was an opportunity to litigate these challenges on a pretrial basis in all of the cases assigned to the Court by Justice Magnuson.

The evidentiary hearing was hotly contested and vigorously presented. There were several interruptions for Court involvement to order further disclosures from both

sides, including one interruption to allow for the deposition of a witness whose expert opinions were not thoroughly disclosed.

Attorneys appeared on behalf of several groups of private litigants who ostensibly located experts, did the work, and funded the challenges to the Intoxilyzer results. A representative of the State Public Defender also appeared and was actively involved in the presentation made by the team of attorneys on behalf of criminal defendants and implied consent petitioners. The Attorney General's Office had several trial counsel present. Prosecuting attorneys were also present on behalf of various jurisdictions throughout the hearing. In sum, a great number of lawyers presented a great deal of evidence in a highly contentious proceeding over portions of 11 days.

Although Rule104, which by its terms does not bind the Court to follow the Minnesota Rules of Evidence -- "In making its determination it is not bound by the rules of evidence except those with respect to privilege" -- the Court did require evidence be presented in accordance with the Minnesota Rules of Evidence.

Casting a large shadow over the hearing was the report of experts Computer Forensic Services, Inc. ("CFS"), who were retained by those who had requested discovery of the Source Code in the first place. CFS opined, after conducting a thorough analysis of the Source Code, that the breath alcohol test results provided by "the Intoxilyzer 5000EN instruments in use in Minnesota provides valid BrAC measurements and functions as designed." (Ex. 166, p. 5.) Although this view was slightly rebutted by one member of the team, Dr. Schubert, who authored a portion of this report and opinion – and testifying 'on his own' or not as a representative of the reporting firm -- there were nevertheless a variety of challenges to the Source Code.

Criticisms of the Source Code

Timothy Black

The principal challenger was Timothy Black. Mr. Black was initially engaged to analyze the Z80 Source Code in the instrument. He has decades of experience with embedded systems. He does not have a university degree but does possess substantial industry experience, initially in design and more recently in debugging code. His own efforts to actually look at the electronic and/or paper version of the Source Code at CMI headquarters in Owensboro, Kentucky, consumed a mere 6.5 hours, according to admission logs provided by CMI and offered in evidence. Mr. Black did however, to his credit, engage in substantial internet research as well as put together several tests and experiments to test how the Code would impact results in 'marginal' or 'extreme' breath testing situations.

The principal shortcoming in all of Mr. Black's criticisms of the 5000EN is the lack of documentation for the testing and experiments he conducted. Despite the occasional selective printout of tests from the instrument, he lacked a disciplined approach to the testing he conducted and to the construction of the apparatus which he used for some of his testing. Much of what he presented was anecdotal in nature, and even when he purported to record with a video camera what he was doing during his testing, the recording appeared to have many of the qualities of a home movie rather than the consequence of scientific testing. The test equipment and many of the results were understood by him to serve as foundation for his opinions. He elected not to bring much of this foundation to court. There were many questions arising from his testimony that were unresolved by reason of lack of documented testing, lack of foundation, and

overall lack of scientific methodology.

Moreover, his initial approach concerning the Source Code was to leave to others a detailed analysis of the actual Source Code. Thus his examination of the Code was self-limited. Those who spent considerably more time in its examination did not share his conclusions. Even more importantly, those spending considerably more time in examination found that the Source Code did not render the test results unreliable, except in the limited areas as discussed herein. The task assigned to this Court was not to determine whether some anomalous results could be generated through experimentation with the device. The question has always been centered on whether the Source Code makes the instrument's test results unreliable.

The testing methodology employed by Mr. Black was premised, according to his testimony, on re-creating the inputs which would be received by the analog portion of the device. He made a spirometer [42] to deliver a measured volume of air to analyze the flow rate and volume measurements of the instrument; prepared a makeshift antenna to test RFI; and provided glue samples to check the interferent detection function. The reason for creating some of these simple "contraptions" was, according to Mr. Black, a means to test in isolation certain functions of the Code. Mr. Black indicated this is what is commonly done in industry when debugging code, especially in the circumstances that he found wanting with CMI's development and maintenance of the Source Code for the Intoxilyzer 5000EN.

The debugging process employed by Black was a direct challenge to determine whether the computer software was performing its intended function. The goal in

[42] A spirometer is a device used to measure lung function in terms of flows and volumes. Mr. Black built a pump which delivered, according to him, a measured volume of up to 3 liters of air. The specifics of this device were not furnished except as it appeared on a video.

creating computer software is to have it operate with the fewest number of errors. He expressed his view that by the process of simulating actual events, problems as small as one line of code being off in one location could be isolated. However, even when aided by the tests he conducted, he did not identify any specific lines of code that may be, in his view, "in error."

Black testified he had to use this process of simulation as there was not a bug database maintained by CMI.[43] In his review of the Source Code, he observed there were multiple developers of the Code. Typically, according to Mr. Black, even in embedded systems there is a database of bugs and fixes, which was not present for the Intoxilyzer 5000EN. He also opined that in his experience, the more developers that work on the code, the increased likelihood of bugs or errors to occur in the software – which in his view was all the more reason to have a database of bugs and responses. As a consequence of his observations, he used an approach that did not test the routine functions of the instrument – as he felt these usually test fine. His search for errors in the Code was directed to the marginal operations of the Intoxilyzer 5000EN.

In order to perform the type of analysis he employed, according to his testimony, he created various devices to run software simulations. His stated goal was to test and collect results. Despite his stated desire to test and collect data, his efforts were strong on the testing aspect and weak on the collection process. With a few minor exceptions, Mr. Black presented only his conclusions – not the data which supported them. Moreover, by omitting the data which he felt supported his conclusions, a serious question remains about the validity of the results that he reached.

[43] Although he testified that there was no file which corresponded to his expectation of there being a bug database in existence, CFS reported that an "Assembler Debug Control File" did exist. (Ex. 166, p. 27.) The contents of this file were unknown to Mr. Black and undisclosed in testimony.

This Court has no doubt and accepts the general premise that all software and its associated source code has bugs present. All experts seemed to agree on this point. To find and explain which, if any, of these bugs or flaws in the Source Code impacts the reliability of the results obtained from the operation of the Intoxilyzer 5000EN is the singular purpose of these proceedings. Mr. Black, through his method of testing at the margins or corner cases, did not assist the Court in a significant way in its conclusions herein.

Mr. Black was given the same access to the Source Code, in both paper and electronic format, as other experts.[44] His testimony at the hearing revealed that he had not seen the paper version of the Code, but to him, it was of no value. He agreed in the course of his cross-examination that there is no particular place in the Source Code he can cite in which errors are present that impact the reliability of the BrAC test results. He qualified this as not surprising since his initial report sets forth his view that the Source Code could not be meaningfully reviewed without also reviewing and analyzing the hardware it runs. He left to others the minutiae of examining the Code. He remained adamant, however, that access restrictions to the Source Code imposed by CMI were in part done to hide the poor quality of the workmanship that went into its development.

Mr. Black's criticisms of the Source Code and its impact on Intoxilyzer results fell into roughly the following areas:

- Self-Test Procedures
- Air Volume and Pressure Measurements

[44] Mr. Black stated he "had no expectation of getting a copy to use of the actual Source Code outside of CMI's headquarters in Owensboro, Kentucky" in his report. (Ex. 14, p. 14.) Apparently he was unaware of the terms of the Consent Judgment and Permanent Injunction at paragraphs 1b and 1c.

- RFI
- Programming Protocol

For each of these points of contention, he engaged in an elaborate process which allowed him to conclude that the erroneous results he was able to obtain emanated from some flaw in the Source Code. The Court finds in only very limited circumstances agreement with his conclusions.

Self-Test Procedures

RFI Antenna

A breath testing subject submitting a sample to be tested on the Intoxilyzer 5000EN does not do so in a random or undisciplined manner. There is a very specific procedure that is administered by a trained operator. In other words, the Intoxilyzer 5000EN is a device which must be attended by someone with recognized training covering established subjects. While the instrument has self-test functions built into the Source Code for several aspects of the test process, the operator is also present to maintain procedural integrity.

Mr. Black criticized, for example, that the antenna for detecting RFI is only connected to the Intoxilyzer 5000EN using a simple RCA phono jack, which plugs into the chassis of the instrument. The antenna itself is built into the tube into which the test subject blows during the testing. The tube is heated so as to minimize condensation of air or alcohol in the tube between tests or subjects. The tube will not heat if this jack is not plugged into the machine. The operators are instructed, as part of their training, to check to determine whether the tube is warm – which will also determine whether the RFI antenna is plugged in or not.

The criticism lies in the observation by Mr. Black that the device has no self-test provision in the Source Code to verify that the RFI antenna is plugged in as a part of the startup self-test sequence. This self-test is unnecessary for the reason explained: The operator checks the tube, which has the secondary consequence of confirming that the RFI antenna is plugged in. There is no need for an electronic self-test when an actual physical verification is an integral part of the instrument operation.

Drift

Mr. Black contends that over time, there can be "drift" in all measurement devices. In the Intoxilyzer 5000EN, he claims that the apparatus has a useful life of five to six years, and the power supplies (voltage) are not monitored for accuracy or covered by the self-test sequence. Consequently, he believes that there is a high probability of electronic drift, yet there is no testing protocol in the Source Code for checking this on a regular basis. In this regard, therefore, he views the Source Code defective by reason of its omission of a self-test for precision in voltage.

He uses voltage as an example of an obvious defect in the self-test as he compares it to the built-in analog device which provides automatic gain control ("AGC") for the light source that illuminates the sample chamber. Since CMI recognized that light bulbs can have diminished effectiveness long-time use, there is an automatic feature to adjust for this – AGC -- which is not controlled by the Source Code.

In Mr. Black's analysis, or perhaps better described as tautology, if one aspect of the instrument is effectively handled by internal self-check and regulation, the failure to do this with other operations of the instrument makes it obviously defective. Notwithstanding the lack of any support for the premise of there actually being a defect

caused by drift, there was equally no evidence or data which indicated how this claimed omission had an impact on the reliability of the result. The conclusion was a simple proposition: The older the machine, the more problems that result. In his view – again, without any supporting data or testing – subtle changes take place over time, leading to an inflation of all test results, even though the results themselves look valid. The Court does not agree.

The lack of self testing, even if a valid criticism goes to an issue of instrument design. Mr. Black had numerous criticisms of the Intoxilyzer 5000EN design sprinkled throughout his testimony. He related these to Source Code by claiming that the defect was an omission in the Source Code. The Court has considered the lack of self testing and rejected same – despite the issue being outside the narrow scope of the initial charge given to this Court by Justice Magnuson.

Air Volume and Pressure Measurements

On this subject area, the Court agrees with Mr. Black – the Intoxilyzer 5000EN, while using Slave Source Code version 240 – that these results are inaccurate in two respects. In some circumstances, the puff counter, that portion of the test result which records the number of puffs offered as part of the test sample, gives an incorrect reading, usually higher than actually provided. Also, the total volume of air provided and recorded is at times inaccurate.

These two areas of inaccuracy appear to have been observed and described some time ago by the BCA. According to the testimony of several of their witnesses (discussed below), these anomalies have their genesis in a revision provided by CMI to the BCA for the Slave software in version 75_0240 in 2004.

It is important to note at the outset, however, that based upon all of the evidence submitted as part of this challenge to the Source Code, the Court finds that the errors in volume and puff count do not affect the reliability of a BrAC measurement as reported from the Intoxilyzer 5000EN utilizing the 75_0240 software. As discussed herein, when a test result is delivered by the current version of the software, (Master) G1408.62 and (Slave) 75_0240, as well as the immediately prior version of the (Master) G1408.56 and (Slave) 75_0240, the test result is, in this Court's view, accurate and reliable. There are, however, implications from these software errors in the result reported as "DEFICIENT SAMPLE" by the Intoxilyzer 5000EN which impact the reliability, solely, of whether or not a deficient sample is actually "deficient." An in-depth discussion of this conclusion is provided hereinafter. To be clear, the test results with a numerical value assigned either accurately report, or in some situations may underreport, a BrAC test.

Mr. Black was able to demonstrate his finding of the volume inaccuracy by utilizing a homemade pump which discharged air into the Intoxilyzer – as would a test subject – by passing a crudely measured volume past the pressure transducer and comparing the premeasured volume with the instrument reading. In several cases of results provided to the Court, the Intoxilyzer 5000EN volume was higher than the measured volume. While this finding is interesting, it is of no moment.

According to the undisputed testimony of all witnesses, the Intoxilyzer 5000EN has strict minimum volume requirements (as well as many other requirements) for test samples. Acceptance of a breath sample is achieved once a subject delivers a breath at a rate of 0.17 liters and sustains it at a rate of 0.15 liters until a minimum of 1.1 liters has been measured. If other additional criteria are met, a test result bearing a numerical

value will result and be reported. If all of the criteria as established by the Source Code are met in terms of minimum values of a supplied breath sample, the air volume reading being higher than the actual sample supplied does not cause the BrAC result to be unreliable—only the volume measurement number. Granted, this is a potential error in the Source Code and has several possible causes, which were not well explained in testimony. The testimony at trial did explain that regardless of the error in the overall volume reading, the Source Code instructions directing that a test be conducted on an appropriate sample, together with all other requirements being met, will produce a reliable test result so long as the minimum requirements are met.

Mr. Black was highly critical of the air pressure transducer being limited to only 1.45 psi, as he could establish that sometimes people blew harder than that when providing a sample. Testimony from several witnesses led the Court to conclude that in the open system which tests breath in the 5000EN, it is a continuum of supplied exhalation which is being constantly measured. The sample chamber is not like a balloon that fills up, holding only so much before it pops. The infrared detector is constantly sending readings to the Slave microprocessor, in timed intervals when volume is sufficient, to compare the slope of the sample. In most situations the pressure, so long as it meets the minimum for acceptance, does not matter. Even variations in pressure will not matter as long as minimums are met, except as discussed infra, when high pressure samples with the 240 version of the Slave software in operation reject the sample. The simple point is if the sample is accepted and tested with a numerical BrAC assigned to the result, the pressure at which it is supplied does not matter.

RFI

Another harsh criticism Mr. Black expressed was the purported inability of the 5000EN to react to RFI except at certain specific frequencies. He cited his tests that were based upon generating signals across a bandwidth from 0 to 1000 MHz. He claimed that the RFI detection built into the Intoxilyzer only reacted to business band frequencies in the 148-156 MHz range. Mr. Black noted that RFI could be caused in a variety of frequencies, and notably, that cell phones operate in the 900 MHz range. Based upon his testing, he concluded that the RFI receptor, in addition to its antenna being subject to disconnection, was inadequate because it did not cause the Source Code to discontinue testing. His view was that given the circuitry of the device, its susceptibility to RFI impact on test results is obvious.

Mr. Black's test device for RFI was a length of wire which he wrapped around a portion of his signal generator. By doing so, he created a specific wavelength, which provided a signal at that particular wavelength. In addition, this was akin to there being a transformer next to the Intoxilyzer. The testimony of Dr. Steven Nuspl is instructive on this point.

Dr. Nuspl explained the laws of physics which direct that when dealing with radio waves, there is an inverse linear relationship with energy and distance. The further away the signal source, the less energy. Equally, high energy waves can have an effect over a greater distance. The test that was being conducted for RFI by Mr. Black directed a wave of a calculable frequency (based on the length of the wire) in close proximity to the instrument. Based on the test design, the result was predictable. Such a strong signal would have an impact, and its frequency was detected by the instrument to be an

RFI source.

Most sources of RFI are neither as close nor as strong as the testing device created by Mr. Black. As Dr. Nuspl explained, cell phone transmission is typically at 0.10 watt/meter in terms of energy. For there to be any possibility of RFI with 5000EN test results, a cell phone would have to be remarkably close to the instrument. Another witness, Mary McMurray—a purported expert—claimed that she was at some meeting in Atlanta at some point in her career at a seminar and observed that a cell phone placed next to an (earlier version) of the Intoxilyzer made it report extremely high results. This observation was not any more supported than that just paraphrased by the Court. There were no specifics, findings, papers, documented complaints, etc. other than a faint anecdotal assertion by her. And for reasons discussed infra, this witness began with bias bordering on antipathy towards CMI breath testing equipment.

Finally, apart from the uninformative testing and unsupported anecdotal assertions concerning RFI, there was a test result introduced from a qualified English laboratory (Exhibit 52). An Intoxilyzer with an identical motherboard was tested for RFI immunity. The test confirmed what was already known, that the 5000EN is not immune from RFI, which is why steps are taken to have RFI detected, and if present, to interrupt the testing process. These test results support the conclusions reached that adequate RFI detection is present, and the Source Code provides a means when detected to indicate RFI as a cause of test failure. This appears to be borne out by testing results reported as of 3/16/06 where it is noted that cumulatively, 0.63% of all 5000EN tests were not considered due to RFI. (Exhibit 7, p.34)

Programming Protocol

It is obvious from the testimony that CMI attempts to squeeze every last bit of functionality from dated microprocessors and has been doing so for many years. Further, the 5000EN instrument is sold to many states and foreign countries. Customers of CMI have a variety of testing protocols to follow and results they wish to record that are different from those in the Minnesota model of the Intoxilyzer. This led to different versions of Source Code being present in the material which CMI produced.

For example, there is a version of the Source Code for the 5000EN identified as the "Norway" code, which utilizes different instructions. This code is present in the Minnesota model, but the differences in operation are disabled in the Minnesota version. Some features of the Minnesota instructions are likely disabled, for example, in the Intoxilyzer used in Idaho, etc.

Apart from describing these differences and updates to the Source Code as hacked in, Mr. Black's cursory examination of the actual Code provides no insight into his claim of defects. Others, such as Dr. Nuspl, charitably described the Code as written for the 5000EN as highly "modular." CFS criticized the Code writing as "many shortcuts...to minimize the amount of memory the source code takes in the instrument..." (Ex. 166, p. 46) Regardless, the experts who took the time to actually look at and evaluate the Source Code found that the manner in which it was written does not present an issue concerning the validity of BrAC measurements.

Mr. Black was content to opine that in his view, the manner in which the Source Code is written leads to error in its reported results. Others who actually conducted a detailed, in-depth review could not support his conclusion. Ironically, CFS, upon which

Mr. Black relied to provide the detailed Code review, rendered an opinion opposite that of Mr. Black. To be sure, there are errors in the Code – but not errors of the type that render results unreliable.

Dr. Karl Schubert

Standard Deviation

Dr. Schubert and other witnesses offered testimony regarding the standard deviation of test results in relation to the Intoxilyzer 5000EN. Some of this testimony involved the Request for Proposal issued by the State of Minnesota and CMI's response. (See Ex. 1, State of Minnesota's Request for Proposal, and Ex. 45, CMI's Response to State of Minnesota's Request for Proposal.) Other testimony involved an article authored by Rod G. Gullberg regarding a statistical analysis study he performed on breath alcohol concentration measurement test data. (See Ex. 42, Rod G. Gullberg, *Breath Alcohol Measurement Variability Associated with Different Instrumentation and Protocols*, 131 FORENSIC SCIENCE INTERNATIONAL 30 (2003) (hereinafter "Gullberg Article"). Based on this testimony and the accompanying exhibits, the implied consent petitioners and criminal defendants argue that all breath alcohol concentration test results obtained from an Intoxilyzer 5000EN are unreliable evidence. In urging the Court to reach such a conclusion, however, the implied consent petitioners and criminal defendants appear to confuse two different standards of deviation and misconstrue their meaning.

Request for Proposal

The Request for Proposal issued by the State of Minnesota called for breath alcohol testing instruments which include limited systematic error. (Ex. 1, Bates p. 26.)

The allowable systematic error could "not be greater than ± 3% or ± 0.003 AC, whichever [was] the larger." (Id.) Testimony indicated this requirement was based upon federal regulations and is derived from testing samples with a known alcohol concentration, not test subject samples. CMI's response to the Request for Proposal and marketing pamphlet both indicate compliance with this requirement. (See Ex. 44, p. 2; Ex. 45, Bates p. 45.) The implied consent petitioners and criminal defendants cite the Gullberg Article and argue that the results of the article indicate the Intoxilyzer 5000EN does not actually comply with the 3% and 0.003 AC requirements. (See Ex. 42.) A close reading of the Gullberg Article, however, indicates a recognized and accepted scientific difference between testing performed by the National Highway Traffic Safety Administration ("NHTSA") using simulator standards and results obtained from human testing. (Id. at 34.) Specifically, the Gullberg Article notes results from human testing will result in greater variability due to the presence of "the biological component," which is "the largest contributor to variability," and expressly seeks to avoid confusion between a comparison of its results and the NHTSA testing. (Id.) The implied consent petitioners' and criminal defendants' reliance upon a comparison between the conclusions reached in the Gullberg Article and the requirements set forth in the Request for Proposal is therefore misplaced.

Gullberg Article

The implied consent petitioners and criminal defendants also cite the results and conclusions of the Gullberg Article to argue Intoxilyzer 5000EN instruments do not provide measured breath alcohol concentration results with adequate precision. The Gullberg Article, however, does not conclude the Intoxilyzer 5000EN fails to provide

results with adequate precision. Rather, the Gullberg Article concludes the calculated "[standard deviation] and confidence internal estimates [] were very acceptable forensically." (Id. at 34.) The Gullberg Article further recommended duplicate analyses should be performed to allow for calculation of an estimated standard deviation, limit of detection, limit of quantification, and improved quality control. (Id. at 35.)

CMI has developed source code which can be used to calculate a standard deviation for each test. According to the testimony at the hearing, Minnesota's version of the Intoxilyzer 5000EN does not include this feature. The implied consent petitioners and criminal defendants suggest it is an error of the Source Code not to report a standard deviation with each test. In making this argument, the implied consent petitioners and criminal defendants also specifically relied upon Figure 2 of the Gullberg Article, which provides a confidence interval for hypothetical test results. (See id. at 34, Fig. 2.) Deciding whether it would be appropriate to require reporting of a standard deviation and confidence interval with every breath alcohol concentration test result goes far beyond the scope of the issue before this Court and into policy decision making.

The Minnesota Court of Appeals has repeatedly held that breath alcohol concentration results need not be reported with a margin of error. Grund v. Commissioner of Public Safety, 359 N.W.2d 652, 653 (Minn. App. 1984) cited by Loxtercamp v. Commissioner of Public Safety, 383 N.W.2d 335, 336-37 (Minn. App. 1986), pet. for rev. denied (May 22, 1986); Hrncir v. Commissioner of Public Safety, 370 N.W.2d 444, 445 (Minn. App. 1985); and Schildgen v. Commissioner of Public Safety, 363 N.W.2d 800, 801 (Minn. App. 1985). See also Barna v. Commissioner of Public

Safety, 508 N.W.2d 220, 222 (Minn. App. 1993); State v. Daley, 384 N.W.2d 539, 540-41 (Minn. App. 1986) (holding correlation of results question of credibility and believability for jury); Daley v. Commissioner of Public Safety, 384 N.W.2d 536, 537-39 (Minn. App. 1986) (upholding results with correlation of less than 90%); Zern v. Commissioner of Public Safety, 371 N.W.2d 82, 83-84 (Minn. App. 1985). Reporting results without a margin of error for tests appears to result from an "interpret[ion that the] DWI statute[] create[s] an offense upon a test reading in excess of the statutory limit [and] presume[d] that the legislature considered the inherent risk of error in the chemical analysis and found it to be tolerably inaccurate." Haynes v. State, Dept. of Public Safety, 865 P.2d 753, 755-56 (Alaska 1993) (citing Schildgen, 363 N.W.2d at 801) (discussing various approaches to margin-of-error problem resulting from measurements). Regardless of the reason, an inquiry into the margin of error created by the measurement process does not involve the Source Code issue before this Court and is beyond the scope of these proceedings.

The practicalities of using statistical analytical tools like a standard deviation or confidence interval require policy decisions before they can be calculated. A standard deviation is used as an analytical tool for statistically interpreting and expressing the variability of sample results around an average. Measurement of an unknown typically involves obtaining results which have some amount of variability. Calculation of a standard deviation is a statistical method of expressing or analyzing this variability. Specifically, a calculated standard deviation provides a single value representative of the distance of individual measured test results from the calculated average of those results. In order to report a standard deviation or confidence interval with each test run

on an Intoxilyzer 5000EN, as requested by the implied consent petitioners and criminal defendants, decisions must be made which will directly impact the meaning of the reported value. For example, a decision must be made about whether the standard deviation will be calculated only from the test results obtained from the subject being tested, or whether some standard deviation calculated from a different sample pool, such as that done in the Gullberg Article, will be used. The meaning and robustness of the reported standard deviation would vary depending upon which method was selected and are far beyond the issues before this Court or the evidence presented.

While Dr. Schubert's testimony – on behalf of himself and not CFS – is interesting, it does not speak directly to the issue this Court must decide. Moreover, Dr. Schubert did not, in his testimony, reject or refute CFS's investigation which was "centered on the ability of the instrument to provide a valid breath alcohol concentration using the supplied source code." (CFS Report at p. 4). Nor did Dr. Schubert's personal testimony overturn the CFS conclusion that the Intoxilyzer 5000EN in use in Minnesota "provides valid BrAC results and functions as designed." (Id. at p. 5).

Sample Acceptance Source Code

Dr. Schubert also addressed in his testimony, as did CFS in its report, a problem rooted in the Source Code and its parameters for sample acceptance. There is, according to both, an issue which is based on a strictness of acceptability for breath samples arising from the manner the sample is provided.

As Dr. Schubert explained at the hearing, the Source Code only accepts as a valid sample that which is delivered at an accepted rate within a pre-set range. This range attempts to eliminate the presence of mouth alcohol and only allows a reading to

be taken if the supplied sample has a certain measured breath alcohol flatness or evenness to it, as can be seen in Figure 1. In other words, until there is flattening out of the readings taken – or as the sample values are a nearly constant value -- the Intoxilyzer 5000EN will not consider the reading acceptable. (The process is explained earlier, under the heading "Sample Acceptance Criteria," pp. 59 to 65). According to Dr. Schubert, the instrument with its present version of software wrongly rejects samples and labels them as deficient in many cases.

As Schubert explained, variability exists based upon the rate at which people blow into the instrument, and there is also some variability in the equipment. The rate of the delivered sample can be interrupted by coughing, stutter in the breath, crying, asthma, smoking history, etc. The Source Code rejects as deficient all samples which do not meet the slope measurements over the timing and acceptability requirements of the Code. He also contends that the Code has a very narrow band used for selection of valid sample points.

Schubert pointed out, correctly, that the instrument "does not detect intent of a person" who is supplying a sample; it merely "analyzes what it reads from the data." Consequently, while there may be many reasons for a sample to be labeled as deficient, the Source Code lacks a means to report why the sample is deficient. According to both Dr. Schubert and the CFS findings, when the Intoxilyzer 5000EN reports a deficient sample, it could be due to either a software failsafe or the conduct of the test subject. The microprocessors running the Code do not have sufficient capacity for error checking and reporting with precision the reason for non-acceptance.

Schubert (and others) pointed out that in the Source Code for the Intoxilyzer

5000EN, there is 'dead' code which is not used in the version of the machine operated in Minnesota. He contends that had CMI taken out the dead code, more room would be available for error checking and reporting; hence, increased granularity. Schubert indicated that in the area of deficient sample reporting, code is present to detect with great precision the cause, yet reporting is without granularity to document the precise cause. To the extent the Intoxilyzer 5000EN reports a deficient sample under some circumstances, this result is unreliable based upon the Source Code of the instrument.

Separate and apart from the issue of lacking granularity is the recognition that the Source Code tightened up slope acceptance in the software release version for the Slave processor, version 240. Dr. Schubert recognized that the criteria for slope acceptance were tight in his review of the software for the Slave chip. He is also aware there was a test hex file prepared by CMI in 2007 to address this narrowing of acceptability (Ex. 7, Bates p. 12), but to his knowledge, the corrective software was not installed by the BCA.

The foregoing can be distilled into a particular conclusion which is within the purview of the task assigned to this Court: The slope detection software, based on its Source Code, version 240, does reject under some circumstances samples which are valid. These "Deficient Samples" could have had particularized reasons for rejection identified, had CMI and the BCA elected to do so. In situations where this result has been reported due to slope acceptance criteria in the 240 version of the software, the BCA could have implemented corrective software but chose not to update the instruments. This conclusion is confirmed by the testimony of the BCA witnesses.

Mary Catherine McMurray

Ms. McMurray is a self-entitled forensic scientist. She claims forensic science is a level of science which should be held to the very highest standards possible in order to withstand any scrutiny. Her principal area of purported expertise is breath alcohol legal cases. She looks at testing, maintenance, and everything that goes into a testing program to see if the test itself really stands up on its own 'face value.' Her principal qualification is a bachelor of science in chemistry from the University of Wisconsin.

In 1992 McMurray got a job working with the Wisconsin State Patrol and its alcohol testing program. The instrument she became familiar with was the Intoxilyzer 5000. She checked and certified equipment, went to CMI training, and was responsible for training people in the use of the instrument.

She described some testing she did in 1996 while in Sheboygan, Wisconsin, for a week. She concluded that internal standards have nothing to do with calibration for the Intoxilyzer 5000. She did not offer any significant findings, results, or report. She mentioned other studies of the Intoxilyzer 5000, but again, without any specifics or results.

Significantly, she did mention an article she worked on as an investigator which looked at denture adhesives and their effect on the Intoxilyzer 5000 results. The article apparently concluded that some denture users had measurable alcohol in their mouths 20 minutes after application of the adhesive. This is the only study she was a part of which ever appeared in a scientific journal.

Ms. McMurray's tenure with the State of Wisconsin ended after about two years, as she left that employment in 1994. Her reasons for leaving border on the

unintelligible, although she expressed, in testimony, that she was being asked by her employer (State of Wisconsin) to lie in court.

Her familiarity with the Intoxilyzer 5000 appears to be with a unit similar to, and likely a precursor to, the Intoxilyzer 5000EN. She had training on the similar device at CMI while CMI was located in Colorado. She has also been trained on other manufacturers' breath testing instruments.

Ms. McMurray's past involvement with testing and the legal system is confusing. Apparently she was reprimanded for a statement made in a trial in 1997 and was criticized by a committee of the National Safety Council.

She denies any knowledge of computer programming and never looked at the Source Code. She got involved in this case to provide advice to Mr. Derek Patrin. McMurray also claimed she got more interested in these proceedings when she learned – not from a report – that Mr. Black, who looked only at the Source Code, found so many problems. She did look at two of Mr. Black's reports, his redacted reports, from October and December 2010 (Exhibits 14 and 16).

She claims to have conducted "little experiments" of the RFI detection capabilities of the Intoxilyzer 5000. She offered nothing in writing and relied only on her experience. She testified that RFI is not a matter of "physics." She could not identify any RFI studies. She has never had access to the Minnesota Model Intoxilyzer; hence, she has done no experiments of any kind on it.

She provided an example of cell phone RFI from a meeting she attended in Atlanta in 2005. Her lack of documentation or even a coherent explanation of what she observed left the Court with no confidence in her conclusions. She indicated that in

some instances – undescribed – a cell phone -- of unknown power and proximity – in the transit mode could influence the test reading. None of this purported RFI and result is documented in any manner, nor was it well explained.

The Court asked her about documentation, and she claimed none of what she observed was conducted in a manner that anyone felt was worth writing up and trying to get published in a scientific journal. When asked directly again by the Court, she admitted there is no scientific literature on RFI by cell phones on the Intoxilyzer 5000EN.

Several arguments were had in the course of Ms. McMurray's testimony which required the Court to adjourn the proceedings at one point to allow a deposition to be taken so that counsel could ask her what her opinions were. Despite the hiatus, Ms. McMurray's testimony continued to follow a path of unsupported criticisms and did not amount to much more than an endorsement of Mr. Black's position.

Ms. McMurray impressed the Court with her position of distrust for the Intoxilyzer and outright antipathy towards CMI. Her bias was demonstrated, and in the Court's view, her qualifications to provide meaningful insight into the Source Code and its alleged problems were never established. In sum, early on Ms. McMurray claimed not to want a direct role in this case, due to her concerns that she may not be qualified to address the issues. Her initial observation about her role was proven correct.

Supporters of the Source Code

BCA Witnesses

Karin Kierzek

Ms. Kierzek was called by the defendants/petitioners based upon her

involvement at the BCA with the Intoxilyzer 5000EN. It is to be noted that she has a degree in biochemistry, without any reported specialized knowledge in software or computer programming.[45] While she is the lead worker on breath testing for the BCA, her specialized training consists of an Intoxilyzer Operators Course at the BCA, a one-week session at CMI in Kentucky, and a one-week program at Indiana University on breath testing and physiology. She has other crime lab training, but the foregoing was all that was presented in terms of specialized training regarding the instrument (and its Source Code) at issue.

She indicated that Patrick Pulju does maintenance and instrument repair for the Intoxilyzer 5000EN, and at the time of the hearing, he had done no maintenance on the devices for the preceding two to two and one-half years. Her testimony revealed that in the past, though there was no set time for recalibration or recertification, the BCA likes to "see them every two years." The only regular recheck is a monthly replacement of the simulator solution on which an ACA test sequence is run. She also indicated that as the simulator solution is run on each instrument with every test, this serves as a means to verify accuracy of test results.

Ms. Kierzek appeared knowledgeable concerning the means by which the Intoxilyzer 5000EN conducts tests, measures slope, deals with RFI, and generally the significance of the DABACABA sequence for testing.

She also responded to some of Mr. Black's criticisms of the consequences of unheated sample tubes (low test result) or capping the sample tube (no impact on result if sample chamber at 0.000 reading; if greater will report a purge failure), and the

[45] Surprisingly, the State and prosecutors did not offer any witnesses with knowledge of computer programming other than their forensic expert, Dr. Nuspl.

imprecision of reported air volume measurement (inconsequential if minimum volume attained) and puff counter (no effect).

There is at least one recognized error known to Ms. Kierzek in the 240 software. She acknowledged that if a sample greater than 1.1 liters of air is given but not accepted for some reason, the puff counter doubles the number of attempts. By 2006 this was known to the BCA and appears to result in the need to have more repeat tests when subjects blow harder.

One of the consequences of someone blowing harder in providing a sample was to cause a slope failure, leading to a deficient sample. A proposed solution suggested to the BCA, according to the witnesses, was to implement self-adjusting slope criteria. This would allow the slope to be based on the flow rate of the sample as delivered. This was considered but never implemented by the BCA.[46]

The problems associated with how hard a test subject blows when providing a sample appears to have developed in 2006. Ms. Kierzek had seen a video which demonstrated a person providing a sample which "in my opinion seemed to be sufficient length and, you know, duration, but it did not accept the sample." This led to the BCA trying to reproduce this situation through in-house testing of an Intoxilyzer 5000EN.

The in-house testing produced results which were documented in a series of e-mail exchanges between the BCA and CMI in the fall of 2006. (Ex. 7, Bates pp. 25-32.) The BCA concluded, per Mr. Pulju:

> The acceptance of samples blown into the instrument is dependent on which version of software the instrument is running. Acceptance is also dependent on how the subject provides the sample, i.e. soft through very hard.

[46] Two BCA witnesses, Pulju and Edin, explained in their testimony that having self-adjusting slope criteria would be somehow unfair to test subjects.

(Ex. 7, Bates p. 28.) According to both Ms. Kierzek and the e-mail exchanges with CMI, there had been no change in the sample acceptance criteria. Further research by the BCA nevertheless concluded that Slave software version 75_240 "seems to have tighter criteria" for sample acceptance. (Ex. 7, Bates p. 27.)

Ms. Kierzek provided an explanation of her understanding, which was borne out by the e-mails: A change was made in the 240 software concerning how calculations were done for detecting interferents. The new means of calculation was done with floating point math, rather than the previous method of integer math. (Ex. 7, Bates p. 27). She explained in her testimony how she understood the consequence of this change:

> I believe the explanation is that the calculations were taking longer. Therefore, it occasionally took longer for the slope criteria to be calculated, and would then require a person to blow occasionally longer in order for the calculation to be updated.

Other testimony supports her conclusion in part. The changes to the Source Code which modified the calculation method for interferents slowed down the process overall and impacts the slope acceptance calculations. This in turn makes sense of the BCA findings arising from its in-house tests, that a larger sample (more volume) is needed for acceptance. (Ex. 7, Bates p. 28.)

Despite the BCA's recognition of there being certain circumstances in which a validly delivered sample was being rejected, and there being a perceived change in the slope acceptance criteria, the witness and the BCA did not 'deem the situation to be a problem.' Rather, it was an 'area of concern' and there 'would be no means or need to notify the public.'

Ms. Kierzek pointed out in her testimony that the BCA got corrective software from CMI to fix this 'area of concern.' According to Kierzek, they did not test the proposed fix, validate it, or install it. This proposed software solution was provided to the BCA in April of 2007. One of the reasons she gave for not doing anything with the software was to not exacerbate the Source Code issue pending in the courts. Another reason she expressed was the cost of testing new software.

Patrick Pulju

Mr. Pulju has the title of "Forensic Breath Alcohol Specialist." He is not a scientist. His training and duties lie in maintaining and repairing the fleet of Intoxilyzer 5000ENs used by law enforcement in Minnesota. He has attended technical schools for instrument repair both generally and for the Intoxilyzer in particular. He works with the data and database derived from COBRA and has worked on validation studies of new Intoxilyzer 5000EN software over the past 10 years. He has been an employee of the BCA for 14 years.

Pulju readily acknowledges problems with the puff counter and volume measurement in the Intoxilyzer 5000EN. He attributes the latter to a sticky check valve which does not fully open. If the check valve sticks in this manner, the pressure transducer will overstate the volume.

Part of his job has been to maintain the instruments, and that involves verifying volume readings. He does so with a 3-liter syringe. He checks this against the setup for the Intoxilyzer 5000EN. The 3 liters is run three times at pressures of 0.25, 0.35, and 0.45 liters per second. The instruments are then certified if the reported volume is within 5% of the measured volume. Results are stored in the maintenance records for

the particular unit.

Despite attempting to recreate the air volume delivery method and result of Mr. Black, he could not duplicate Black's effort.

Pulju explained that if the air purge in the sample chamber comes up with a positive value at 0.015 or above, the unit will report a "Purge Fail." If the level of alcohol in the sample chamber is 0.014 or less, it self-adjusts, making this the zero value for the ensuing test. Thus, if there is alcohol in the sample chamber at 0.014 or less, this amount is the baseline for the next test. The effect is to reduce the reported value for the next test by the amount of the pre-existing value. This leads to an underreporting of the BrAC in this particular situation. Most of the time, the sample chamber will be clear and the 0.000 value will be 0.000.

Pulju was questioned extensively about an e-mail he wrote on September 27, 2006. (Exhibit 7, Bates p. 32.) The e-mail summarized his conclusions that sample acceptability correlates with how hard someone blows. He thinks this makes sense, in that slope is steeper with a harder blow. This observation is also associated with the version of software being run on the Intoxilyzer 5000EN. He indicated all Intoxilyzer 5000ENs in the field are now running the 240 software, which exhibits this problem.

In an exchange with counsel concerning the proposed correction for this problem (Ex. 7, Bates p. 12), Pulju first denied, and with his memory refreshed later agreed that the testing, validation and implementation of the proposed new software was not implemented because the Attorney General's office was slowing them down.

He was also able to identify the rationale and suggestions for a self-adjusting slope criteria which date back to 2001 (Ex. 7, Bates p. 670) and follow-ups in 2003.

(Ex. 7, Bates p. 673.) The idea that the software accommodates how hard a subject blows when considering acceptance was apparently a reasoned solution to a problem that had been around for some time. In addition, it appears that the witness recognized that invalid samples are constantly being overwritten as the instrument either rejects a sample and reports a test, or doesn't accept a sample and continues to analyze what's being provided. The Intoxilyzer 5000EN, due to limited memory, does not keep the history of attempts and related results.

Pulju disputed the earlier testimony from a BCA witness about maintenance on the Intoxilyzer 5000ENs. He indicated another BCA employee, Harold Weatherson, has been maintaining the fleet for the past two years.

Pulju has never looked at the Source Code. He did understand that the reason for non-acceptance of certain samples with the 240 software arose from the delay in calculations. He explained that he was trained on how the calculations of breath are made in accordance with the algorithms in the Intoxilyzer 5000EN. His explanation revealed that the raw data for the calculations is obtained from the rotating IR filters at 2400 RPM, which produces 40 raw data points per second. The slope calculation is based on averages which are calculated after 30 data points are received. Thereafter, the next 7 data points are considered with the previous 23 to produce another average result. The slope is calculated based upon 10 of these averages, which means that a sample for slope analysis is received in about 2.3 seconds for each IR filter which is used for calculating slope. Overall, the process of slope acceptance calculations are done within 2.35 to 2.4 seconds.

Pulju explained that in response to getting a hex file, which would have corrected

the problem raised in his September 2006 e-mail, he tried the text.hex file twice and it failed due to data entry aspects being out of order. No further work or testing was done to correct the issues he raised concerning sample acceptance.

Pulju was asked about the process of implementing any software change and how it goes through validation testing at the BCA. This testing has several variables but typically takes three people, full time, three to four weeks to complete. Pulju indicated that Mr. Black's tests bore no relationship to the validation testing done by the BCA.

Pulju appeared to be the only witness with firsthand knowledge of the specifications of components for the Intoxilyzer 5000EN which are involved in volume measurements. He explained the maximum pressure that can be handled by the pressure transducer is 1.45 psi. He further explained that when he used the expression 'eye popping hard' in regard to the manner of blowing into the instrument, the pressure value is about 1.2 psi.

Many questions were directed to Pulju concerning RFI. He explained the metal box in which the instrument operates acts as a large Farraday cage, which prevents RFI from impairing the operation of the instrument. If RFI is detected, the Intoxilyzer 5000EN is programmed to shut down. He pointed out, in reference to Mr. Black's testimony, that the RFI detection is operational when the unit is actively testing a sample. In the idle and data-entry modes, the RFI detection is not operating. In addition, Pulju explained that he personally conducted RFI testing with police band frequencies and that he is aware of the UK study which, to his knowledge, indicated that the Intoxilyzer 5000EN was not RFI immune, but if detected, the instrument would stop testing.

Through counsel for the State, Pulju was examined about data derived from COBRA, which stated summaries of the rate of testing and failure modes for all versions of software (as of March 16, 2006). (Ex. 7, Bates p. 34.) According to Pulju, the data shows historically, 90% of the Intoxilyzer 5000EN tests are complete, which indicates they are free of failures and represent valid tests.

Focus was placed on the test results for those test subjects who provided the requisite volume (1.1 liters) and had their test reported as a Deficient Sample. The rate is under 1% -- actually being 0.67% under the 56_240 software and 0.60% under the current 62_240 software based upon approximately 48,000 tests. It was represented by him, dismissively, that this low rate of deficient samples was in line with expectations. It was during cross examination that the obvious tripling of the rate of Deficient Samples with requisite volume was shown to occur when the 240 software was adopted. While small in overall percentage, the rate was 0.21% under the prior software versions (43 and 37).

The differences in the software were highlighted on cross examination. It was established and agreed by Mr. Pulju that under the software version preceding the 240, a person who is blowing hard would nevertheless have supplied a sufficient volume for a test at 1.1 liters. Under the 240 software, the required volume is increased by about two-thirds, meaning the subject if blowing hard would need a minimum sample size of 1.8 liters for acceptance.

Pulju agreed that over time, the slope is not exactly flat. He further agreed that the longer a person blows, the higher the reading, as deep lung air is being sampled. Although he ultimately disagreed with the premise of increasing alcohol readings over a

longer duration, Pulju accepted the premise that the new software requires more volume. As time is also a factor, it appears the 240 software increased the likelihood that a sample will be deficient, and this is borne out by the statistical evidence provided.

It appears from his testimony that the 240 version of the software was supplied by CMI in 2000. The State installed the v56_240 in June of 2004, operating this version until June of 2005, when the v62_240 was installed. Pulju indicated that by September 2005, the v62_240 was in exclusive use in Minnesota's Intoxilyzer 5000ENs.

Pulju agreed to the fairly obvious consequence of changes in the software and its impact on sample acceptance. When put to him directly, he acknowledged that the instrument, based on current software (240), will reject some samples and label them as deficient which otherwise would have been accepted under earlier versions of the software. Pulju says it is a miniscule amount of samples. Further, he maintains this all arises from the time differences in sampling by reason of the changes CMI made in the Code for interferent detection.

Regardless of the banter between the witness and counsel, and counsel among themselves, it appears that the BCA was aware from the fall of 2006 onward that a change in the Source Code was made that caused, under some circumstances, previously acceptable breath samples to be rejected. This software, version 240, continues to be used with knowledge of this problem and without change or correction by the BCA.

David Edin

Mr. Edin has a bachelor of science degree in medical technology and a law degree. He has been with the BCA for 10 years and carries the title of "Forensic

Scientist." His work is principally in the breath test section, where it appears he does something of everything in relation to the State's alcohol breath testing program. He has also attended training at CMI and Indiana University in connection with his work for the BCA.

One of Mr. Edin's duties was to respond to allegations to the press made by counsel for criminal defendants, including Mr. Ramsay, about the accuracy of the Intoxilyzer 5000EN. Edin prepared a memo, which to his mind effectively refuted the points Ramsay was making, points which all appear to be derived from Pulju's memo of September 27, 2006. (Ex. 7, Bates p. 32.) The witness maintains in his memo to his bosses (Ex. 106) there was no change in the slope acceptance criteria; and in fact, the problems only arose from a test subject who was in violation of the operators' instructions. The statements and examination of Mr. Edin on these points did not add much to an understanding of the issues but did confirm that issues raised in Pulju's e-mail do not impact results of reported tests; the only discernable impact is upon sample acceptance.

Mr. Edin looked at about 20 different test records for individuals involved in these consolidated proceedings whose test results indicate Deficient Sample. He described in depth Exhibit 107, which was a test labeled as a Deficient Sample. Mr. Edin opined the reason for the deficiency was the lack of a reading of 1.1 liters total volume in the second sample. Edin concluded this was a conduct-based problem caused by the test subject. He further explained that the problem Pulju had raised was due to blowing hard, and Exhibit 107 is not evidence of this particular problem. He concluded that none of the 20 or so individuals involved in this consolidated case, based on their test

records, provided an adequate sample based upon their conduct at the time they provided a test sample.

Edin pointed out that the instrument does not determine intent. He indicated that operators are trained to report a test refusal when they find conduct which prevents a breath sample from being accepted.

Edin confirmed in his testimony the issue of the impact of hard blows on testing is in the Slave processor. He, too, believes that by reason of CMI providing additional interferent detection, the processing time is increased for the slope measurement.

Mr. Edin explained that in operator training, they "pound" on their operator trainees to make comments on the test report concerning a subject's behavior when providing a sample. Edin indicated that it was essential to have contemporaneous information, especially for use in court. He noted that not everything can be explained or interpreted by the numbers generated by the instrument.

Edin also explained that the enhanced interferent detection provided in the software update 240 for the Slave microprocessor was not requested by the BCA. This was included as a part of a package of updates from CMI. The BCA did not ask that the software be rewritten, as the completion rates of testing did not change. Edin was aware that in the area of deficient samples where the volume of air supplied by the test subject was over 1.1 liters, there had been a three-fold increase with the 240 version of software.

Matthew Willis

Mr. Willis is one of the principals of CFS, Inc., and one of the principal investigators of Source Code issues for petitioners and criminal defendants. He was

called in the State's case in a fairly unusual procedural posture. He was called (and his testimony limited) to describe the work of another CFS team member and witness, Dr. Karl Schubert.

CFS placed the petitioners and criminal defendants in a fairly difficult position. CFS prepared a report based on a thorough and comprehensive review of the Source Code for the Intoxilyzer 5000EN. This report, which was disclosed by counsel, ostensibly found no problems in the Source Code which impacted the reliability of test results. While the report had several suggested changes in procedures and disclosures related to the operation of the instrument, overall CFS saw itself as the neutral fact-finding expert and concluded that the Source Code operating the 5000EN provided a valid BrAC reading.

With this backdrop in place, the petitioners and criminal defendants sought to use Dr. Schubert as a means of exploring certain of the CFS findings which went to reliability. Schubert – as made clear earlier – testified based on his knowledge and investigation, not as a CFS witness. Consequently, the State sought to limit or otherwise attack the independent testing of Dr. Schubert with the official position of his employer, CFS, through Mr. Willis.

The testimony was unclear as to whether Willis actually has a degree from Stetson College, but he did attend there four years. He also is knowledgeable in software, firewalls, and data security. He joined CFS in 2003. In connection with the Source Code project, Schubert was a contractor with CFS and Willis supervised his work.

The breakdown of the Source Code analysis was Schubert worked on the Z80

code; Willis, the 8051. Willis pulled the report together. (Ex. 166.) Schubert wrote all or portions of the report in Sections 1-6 and 8. Schubert performed research into uncertainty analysis – specifically, what other states had done for the Intoxilyzer. It was observed in the testimony that the Gullberg article (Ex. 42), which deals with uncertainty in results for the Intoxilyzer, was available to both Schubert and Willis at the time that the CFS report was prepared.

The CFS report in Section 8 discussed an alleged uncertainty of measurement. CFS recommended more study. The suggestion was made by CFS that an allowance be given in reporting BrAC test results – developed through further study. The Gullberg article, according to Willis, was not helpful, as it pertained to biological variance, not machine variance.

At bottom, Schubert felt the results should be expressed with a range of error of 10% for Intoxilyzer results; Willis disagreed. Schubert, at the urging of petitioners' and criminal defendants' counsel, opined that in his view, the uncertainty principles of scientific measurement require a range for reporting results – largely premised on the standard deviation data set forth in the Gullberg study. The Court has considered and commented, in depth, on the testimony of Dr. Schubert and rejected the suggestion that a range be expressed in the reported test results from the 5000EN.

Dr. Steven Nuspl

Dr. Nuspl's qualifications to address matters related to the Source Code of the Intoxilyzer 5000EN were well established. He has an undergraduate degree in engineering and a Ph.D. in electrical engineering from the University of Illinois. He has studied and designed computer chips, electromagnetic theory, worked with embedded

systems, assemblers and a wide range of applications. He had direct experience in programming using the 8051 and a compiler similar to that used by CMI. He also has many years of experience with the Z80 and the assembly language. He has used C-code for programming since the early 1980s.

As part of this assignment, Nuspl examined both the Source Code on paper as well as spending significant time looking at the Source Code as it was made available by CMI in Kentucky on two separate occasions.[47] Nuspl understood and explained the different means by which assembly language and C code is used to create hex files for updated instructions.

From his testimony it was apparent that he conducted a very thorough review of the Source Code. He utilized a computer in accordance with requirements of the Protective order and Nondisclosure Agreement to conduct an analysis while at CMI.

Nuspl structured his review and written report (Ex. 100) in three parts. Initially, he conducted a review of the Source Code for obvious errors. Thereafter, he commented in his work on the reports of Mr. Black and CFS.

Nuspl's testimony and report, as may be obviously inferred, were both critical of Mr. Black. Nuspl viewed Black as conducting what are termed "Black Box Tests" of the Intoxilyzer. These he defined as comparing the interaction of the device with performance standards. Principally, he criticized Mr. Black for not focusing on issues related to the Source Code. In addition, Nuspl expressed some doubt with Black having overlooked the fact that a trained operator is part of the instrument's regular use.

Many of the criticisms of Mr. Black's approach have already been observed and

[47] It appears he was present looking at the code at CMI for 30-35 hours during his first visit, and a "full week" on his second visit.

noted by the Court based upon the Court's own observation of Mr. Black's testimony and review of his work. Nuspl provided repeated material references to the actual Code when making observations about the findings of others – such as Mr. Black – as well as to document his own work. These references to the Code explain in some detail where many of the criticisms of the Source Code can be characterized as superficial.

An example can be found in the file header designation of "FIL" present in the Code. CMI uses the same code base for all of its clients. Different jurisdictions require different test sequences, and even different tests, to be run than are used in the Minnesota Model of the Intoxilyzer 5000EN. These differences can be observed in the Code, as all the code that can possibly run on the instrument is present. The "FIL" header directs which code is to be executed, acting like a switch. In this manner, subject matter functions in the Code appear to be grouped together or in modules. This allows some efficiency for CMI in maintaining and modifying the Code.

Black found this modular method of programming unacceptable based upon his 6.5 hours of Source Code review; Nuspl, after looking at the Code for two weeks, was not bothered by it at all. Black called the Code "hacked in"; Nuspl did not reach the same conclusion. In sum, the experts were all tasked similarly: Are there errors present which affect reliability of the result? How the Code itself is managed by CMI is not at issue, except to the extent that it produces errors. Nuspl did not find any errors by reasons of the Code's organization or style.

On the subject of RFI, with demonstrated knowledge of electromagnetic theory and science, Nuspl undid much of the criticisms of Mr. Black. According to well-established principles of physics, radio waves can be blocked through shielding – which

is achieved by the Intoxilyzer 5000EN through its metal casing. Filters are present in the electrical power cord. In addition, there are about fifty lines of code which direct that if the machine is testing, the analog RF detector is to be activated. Other testimony established that if detected, it is noted and the testing process is aborted.

Nuspl explained that Black's RFI test results were in essence creating a transformer by means of the construction of his test rig. Further, that the test rig was presenting the signal in such a manner that it duplicated a particular wavelength, rather than the full spectrum of wavelengths – which explained the limited response of the RFI detector in the subject unit. As for cell phones, energy they produce when transmitting is so small that they would need to be very close to cause a problem, as there is an inverse linear decline in signal strength based on distance. Even at full transmission, cell phones operate at very low energy. In addition, the low power RFI when in close proximity is blocked by the metal case surrounding the Intoxilyzer.

Both Mr. Black and CFS commented on the use of rounding and truncation in calculations and reports of results in instrument tests. The Court is satisfied with Dr. Nuspl's explanation in that the Intoxilyzer 5000EN does systematically perform calculations to a higher degree of precision than is actually reported. For example, the BrAC data is calculated to three decimal places but reported to two decimal places. The instructions for reporting the two decimal numbers does not get rounded up from the third decimal. In other words, a calculated test result of 0.079 gets reported as 0.07. Normally, there would be rounding up of the report to 0.08 – but the Intoxilyzer is programmed not to do this and leave the lower number as the final test value.

There is however one area in which Dr. Nuspl could not or did not have an

explanation. Dr. Nuspl was apparently not shown, or had not seen the September 27, 2006 e-mail of Mr. Pulju (Ex. 7, Bates p. 28) which commented on increased volume requirements and sample delivery issues being dependent on which software version was being used. Nuspl understood the algorithm used to determine BrAC and further both understood and explained why this algorithm only requires a minimum volume as necessary for a test to be conducted; supplied at a minimal rate over a short time. He was not called by the State – or even prepared to respond – to the purported "tightening" of the slope criteria which arose from the delay in computation present in the 240 version of the Slave software. The State's witnesses characterized this situation variously, but at least at one point Mr. Pulju commented that the 75_240 Slave software had tighter (slope) criteria. (Ex. 7, Bates p. 27).

Nuspl was not given earlier versions of the software to compare or analyze, except that of course which appeared in the notes of that which he reviewed – to the extent the earlier code was present. He appeared both unprepared and uneasy in his efforts to respond to questions concerning "Deficient Sample" being the result of delayed slope calculations.

Apart from his inability to meaningfully comment on the 'Deficient Sample' issue, Dr. Nuspl's testimony was informative. He took some exceptions with the work of CFS on matters that do not appear to be error producing, e.g. buffer overflow. In the near entirety of the CFS observations, Nuspl was in agreement. Even on the slope acceptability/deficient sample issue, Nuspl carefully chose words to express his opinion that CFS's criticisms "are neither a basis of disputing Intoxilyzer 5000EN BrAC readings already taken nor a basis for preventing future BrAC readings." (Ex. 100, p. 47).

Overall, Nuspl found no defect in the Source Code that does or could affect the reliability of test results provided by the instrument.

CONCLUSION

This Court has endured every claim, defense, and position that can be advanced for or against the Source Code having an impact on test results of the Intoxilyzer 5000EN. These assertions have been made in writing, through arguments of counsel, testimony of witnesses, exhibits covering a wide spectrum of information, and even video recordings of the work of expert witnesses. Through an accumulation and assimilation of this vast amount of information, the Court has been able to glean several key components from this litigation.

1.) Scientific measurements of human biological material (breath) have inherent limitations of precision. Test devices, including the Intoxilyzer 5000EN, produce valid test results, subject to the earlier discussions set forth in this memorandum, that meet policy and statutory requirements. These results are not perfect every time, yet in the case of the 5000EN, the results are highly reliable. The results in nearly all situations provide a recorded measurement that should be afforded evidentiary value.

2.) All Source Code and related software, including that which controls the Intoxilyzer 5000EN, has some number of errors present. In the near entire range of test results generated by the instrument, these errors have no significant impact. There is one limited situation, as discussed earlier, in which the labeling of a sample as "deficient" arises from multiple causes. At least one of these causes is a consequence of the Source Code's instructions to the microprocessors and has little, if anything, to do with whether the sample is actually deficient.

3.) The conclusion that the Intoxilyzer 5000EN used in Minnesota can be characterized

as 'robust' is apt. The components of the systems within the device are durable, but most importantly, the DABACABA test sequence provides a reliable benchmark for each test. Within this test sequence is the test of a known control solution, near in time to subject testing, that provides scientifically accepted validation for the test process. Moreover, for the near 14 years of use of the device, 90% of the attempted tests have produced valid results. The remaining 10% of tests in large measure have been stopped or not considered by reason of reliability and testing integrity issues, software, or conduct of the test subject which inhibits the testing process. In this regard, breath alcohol test values obtained from a 5000EN are stated conservatively.

4.) There is a general perception that perfection and flawless operation is present in the Intoxilyzer and its test results. Those responsible for the operation and maintenance of the device have been defensive and at times outright hostile to the suggestion that problems may exist, which has in turn led to the instant challenge. The problems and limitations, especially in the Source Code when fully understood, do not materially impair accuracy, validity, or reliability of the results. A less defensive posture and access to the Code at an earlier time would likely have increased confidence in results and reduced the need for this protracted litigation.

5.) The Intoxilyzer 5000EN is severely challenged in its operation by reason of its limited data processing capacity. The instrument appears at the edge of its usefulness. Source Code changes to correct needs or issues result in creating other issues, as demonstrated by the increased time for calculation of interferents which slightly narrows the range of acceptable samples. This problem is caused by

the Code and how it needs to be written for use on slow, capacity-limited microprocessors.

6.) Numerous government policies, including Minnesota Statutes, direct alcohol breath testing. The Source Code, for the most part, operates in a manner to produce test results in accordance with these policies. For example, BrAC results are limited to two decimal places and not rounded – up or down. This is inconsistent with normal scientific practices. However, even though more accuracy is available, it is not demanded by existing policies or practices. Much of the criticism of the Source Code was focused on either alleged omissions – or processes which are the result of policy decisions. The repeated criticism of the Source Code in many respects should be redirected at the policies which it reflects, not the Code itself.

There are many additional points raised by the parties which have not been addressed in this decision. All issues, evidence, and arguments submitted have been considered. To the extent that anything that has been presented to this Court is not expressly ruled upon or mentioned in this decision, such positions, in whatever form, should be considered rejected.

The Court did not intend to leave any arguments for another day by omission from this Order and Memorandum. Rather, this decision is at least long enough – or perhaps too long – to benefit from further detailed analysis.

JBA

3/7/11